JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

JULY, 1831.

On the Quadrature of the Circle, by the Editor.

Although the practicability of making a perpetual motion is a question settled in the negative by every man well versed in the principles of mechanics; and although those acquainted in the higher geometry, have given up the attempt to square the circle, or, in other words, to find a square the area of which shall be exactly equal to that of a circle whose diameter is given; we are yet not unfrequently amused, through the medium of the journals of the day, with the assurance, that what has eluded the researches of the most able engineers, and the most profound mathematicians, has been *luckily* discovered by some sciolist, without the use of the midnight lamp. In a former number of this journal, we gave some account of the most prominent schemes of perpetual motion, and it is our design in the present article to notice the attempts which have been made to square the circle.

We have been directed to this subject by some recent publications in the papers of Washington city, in which a gentleman in one of the public offices, has triumphantly announced his most complete success in this difficult, if not impossible problem; and informs us that he has entrusted his secret to fifteen individuals, all of whom are perfectly satisfied of the correctness of his principles. We are not told how many out of the fifteen are capable of forming a judgment upon the subject, but we happen, however, to know that at least one of the number is unacquainted with the meaning of decimals; and we also know that those most capable of deciding the question are not, and have no desire to be, of the number of the initiated. A few years ago

a similar announcement was made in the Richmond papers; but when the plan was presented to the public, it proved to be one of those gross mechanical modes of approximation, which have been repeatedly proposed. A cube and a sphere were to be made, and their relative masses ascertained hydrostatically. An approximation as inferior to that which the mathematician has obtained, as matter is inferior to mind. Others have proposed to cut a square and a circle out of a plate of metal, or other substance, both equal in thickness, and then to weigh them, ignorant of the fact that neither the weight or dimensions of such articles is capable of being ascertained with a millionth part of the correctness with which the mathematician has squared the circle.

The subjoined account of what has been proposed, and done, upon this subject, is abstracted entirely from MONTUCLA, as contained in his "Recreations in Mathematics," translated by HUTTON.

Montucla divides those who have pursued this inquiry into two classes; the first, geometricians, who, aware of the difficulty or impossibility of the problem, have not been led away by illusions, but have confined themselves to the finding out the most exact methods of approximation. The other class, those who scarcely acquainted with the elements of geometry, and hardly knowing on what principle the problem depends, have twisted and turned the circle in every direction, and have laboured, like the unfortunate Ixion, eternally rolling the heavy burden, without bringing it any nearer to its place of destination. When one error is pointed out to them, they soon return with their propositions in a new, but equally contemptible form; and unhesitatingly contest the best established truths in the elements of geometry, appearing to believe themselves specially appointed by Heaven to reveal truths to mankind, the discovery of which is withheld from the learned, that it may be bestowed upon idiots.

In the time of Aristophanes, the question of the quadrature had already become celebrated, as in order to ridicule Meto, he introduces him on the stage, promising to square the circle.

We first find in the writings of Archimedes, the announcement of the truth, that the circle is equal to the rectangle of half the circumference by the radius. Still something more was necessary, namely, to determine the proportions between the circumference and the diameter; and although he was unable to accomplish this with mathematical precision, he showed that the diameter being 1, the circumference would be more than $3\frac{10}{71}$, and less than $3\frac{10}{70}$, or $3\frac{1}{7}$.

Since that time, if great exactness be not required, in order to find the ratio of the diameter to the circumference, the proportion of 1 to $3\frac{1}{7}$, or of 7 to 22 is employed; that is to say, the diameter is tripled, and $\frac{1}{7}$ of it is added: this seventh is never neglected, but by the most ignorant workmen.

Among the modern geometricians, the first who made any addition to our knowledge on this subject was Peter Metius, of the Netherlands; whose name was mentioned in connexion with the discovery of the telescope in our last number. He ascertained that the propor-

tion between the diameter and the circumference of the circle was very nearly expressed by the terms as 113 to 355; the error being scarcely the ten-millionth part of the circumference.

The celebrated James Gregory of Scotland, undertook, in the year 1668, to demonstrate the absolute impossibility of the quadrature of the circle, and although his conclusions were not universally admitted, they have never been disproved. He gave several very ingenious methods for approaching nearer to the measure of the circle than had been previously done.

The numbers expressing the proportions between the diameter of a circle and its circumference were carried out by M. de Lagny, to 127 figures, or decimals; by which it was shown that if the diameter be represented by unity, followed by 127 ciphers, the 128 figures which he has given as representing the circumference, and which commences with 314, and terminates with 446, will be less than the circumference, whilst it will be greater if the last figure be increased by unity. If we suppose a circle, the diameter of which is *a thousand million times* greater than the distance of the sun from the earth, the error in the circumference would be *a thousand million of times* less than the thickness of a hair.

Euler has pointed out the method by which we may go still further, but there are few who would not pronounce the labour to be superfluous. The supposition, therefore, that there is in England a standing reward of £10,000, or of any other large amount, awaiting the discoverer of the quadrature, must be placed among the prevailing vulgar errors; for with all her liberality, Britain does not give such rewards for the discovery of that which would be of no practical utility whatever.

Among those who have miscarried in their attempts to solve this problem, or who have fallen into ridiculous errors respecting it, the following are noticed by Montucla.

The celebrated Joseph Scaliger, who had no great esteem for geometricians, desirous of showing to them the superiority of a man of letters, in solving, by way of amusement, what had so long puzzled them, attempted the quadrature of the circle, and seriously imagined that he had discovered it. The quantity which he gave was a little less than the inscribed dodecagon. It was therefore an easy task to refute him, which was done by several mathematicians. The only effect produced upon Scaliger was, to throw him into a violent passion, and induce him to pour forth a torrent of indecent abuse upon the geometricians, and to confirm him more than ever in the opinion than they were destitute of common sense.

The celebrated Danish astronomer, Longomontanus, pretended to prove that the diameter of a circle is to the circumference exactly as 100,000 is to 314,185. The famous Hobbes imagined also that he had discovered this long sought secret; and upon being refuted by Dr. Wallis, he published a work with a design to prove that the whole system of geometry was founded upon false reasoning.

A certain M. Liger pretended that he had found out the quadrature of the circle, and commenced by demonstrating that the square

root of 24 was the same as that of 25; and of 50 the same as that of 49. This he attempted, not by geometrical reasoning, which he set at nought, but by mechanical contrivances, aided by figures.

M. Clerget made the wonderful discovery that a circle is a polygon with a determinate number of sides, and he thence deduced the magnitude of the point where two unequal spheres touch each other. He demonstrated also the impossibility of the motion of the earth. The affinity of these questions with each other has never been perceived by any other philosopher.

M. Mathulon, a manufacturer of stuffs at Lyons, undertook to act as a geometrician and mechanist, and in support of his pretensions announced that he had discovered the quadrature of the circle, and the perpetual motion. He deposited 1000 crowns to be awarded to any person who should prove that he was in error. M. Nicole effectually did this, and the thousand crowns were awarded to him, and were presented by him to the general hospital at Lyons.

A similar offer of a sum nearly double the amount, was afterwards made by an individual more distinguished for the possession of money than of mathematical learning. His method was to divide a circle into four equal parts by perpendicular diameters, and then to turn these quadrants with their four right angles outwards, so as to form a square, which square he pretended was equal to the circle, although it was manifest that the parts could touch each other in points only, instead of in their whole extent. Three persons appeared as claimants for the reward, so ridiculously offered, but the tribunal at the Chatalet decided that a man's fortune ought not to suffer from the errors of his judgment, when those errors were not prejudicial to society. The author of this offer obtained a sentence from the Academy of Sciences, which was that he should study the elements of geometry; he, however, was still convinced that he had been treated with gross injustice, and that future ages would blush for that in which he lived. Although but few of the pretenders to this discovery cut a figure so completely ridiculous, it is nevertheless true that their propositions have all of them had their foundations in ignorance of geometry.

It may be acceptable to those unacquainted with geometry, to learn how a very close approximation may be made to the ratio between the circumference and the radius of a circle, which is in effect the same as discovering the quadrature. If a polygon of any number of sides be inscribed within a circle, and another be circumscribed, both touching it, the two areas thus formed can be ascertained by mensuration, and the exact circumference of each figure may be readily ascertained. Now it is evident that the circumference of the circle must be greater than the one, and less than the other of these polygons. Wellebord Snell, a countryman of Métius, laboured assiduously on this subject; he calculated a series of polygons, up to 5,242,880 sides, so that when it is pretended that a proportion between the diameter and circumference of the circle, his table furnishes the mode of refuting the pretension.

There is an ingenious and simple mechanical mode of proving that

the area of the circle is equal to the rectangle of one-half the circumference, by one-half the diameter. Or, in other words, is equal to that of a right angled parallelogram, two of whose sides are equal to one-half the circumference, and the other two to one-half the diameter. Suppose a circle to be taken, and radii to be drawn from its centre to its circumference, numerous, and at equal distances from each other; then let this circle be divided into two parts, each a semicircle; cut through the radial lines from the centre close to the circumference, and open each semicircle out, so that the semi-circumference of each part shall become a straight line, the points of one piece will fit exactly into the spaces of the other, and the rectangle in question will be formed.

On the Application of Anthracite Coal to the Drying of Tobacco. By Erskine Hazard, *Esq. Engineer.*

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Sir,—I noticed in your valuable journal for this month that a patent had been taken out for a plan for curing tobacco. It immediately occurred to me that this object could be very easily effected by placing a grate, with a Lehigh coal* fire in it, in a "tight house" in which the tobacco is hung. The stove or grate to be a moveable article to be placed on the earth floor without any connexion with stove pipe or chimney—the crevices in the roof will furnish a sufficient vent for the gas. This stove or grate is simply a sheet iron

cylinder 12 to 14 inches diameter, and of the same length, with a grate at the lower end of it to hold the coal, and open at top, supported by three legs rivetted to it. It should have two eyes or handles rivetted to the top for the purpose of running a small bar of iron through, by which two persons can readily carry it while ignited from one place to another, or two holes punched through the cylinder near the top will answer the same purpose.

In a larger building, two or more of these stoves may be used and will produce any degree of heat that may be desired, and they will not cost more than two or three dollars each.

No danger need be apprehended of the gas arising from the combustion producing any unpleasant flavour in the tobacco—of this, the experience of the brewers who all dry their malt on this principle by permitting the gas to pass through the body of the grain on the kiln, and of many families in this city who constantly bake their bread, cakes, pies, puddings, &c. in the gas, (also on the same principle,) without imparting any peculiar flavour to them, is sufficient evidence.

It is very common at Mauch Chunk, when *seasoned lumber* is required, to pile the green lumber on posts, about eight feet above the ground, and enclose the whole with boards tacked to the pile to confine the heat, and then introduce a grate with coal into the inclo-

* Anthracite.

sure. The whole pile is thus completely dried in 6 or 8 days, and requires no other attention than to renew the coal in the grate three times in twenty-four hours. The Lehigh coal will be found a very convenient article applied in this way in all the processes where drying is requisite, and particularly in kiln-drying corn. By removing the grates from the building while the ashes are shaken out and the grate replenished with coal, no inconvenience will be experienced from dust.

As persons who are not accustomed to the use of Lehigh coal, may wish to try this plan, it may be well to state the mode of kindling the fire. Cover the grate with a *thin stratum* of Lehigh coal, then add a quarter of a peck of charcoal—apply your fire, fill up the grate with Lehigh coal, and then *let it alone.* To renew the fire—with a crooked poker clear out the ashes from the bottom of the grate and fill up with fresh coal. The bars of the grate should be an inch and a quarter apart.*

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, May 26, 1831.

Professor ALEXANDER D. BACHE was appointed chairman, *P. T.*

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Matthew Carey, Esq.

Marriott's Dictionary, 2 *vols. quarto.*

Cobbett's Weekly Register, 1 *vol.*

By Reuben S. Gilbert.

The Laws of the Province of Pennsylvania, collected in one volume by order of the Governor and Assembly of the said Province, 1714.

The Cabinet of Natural History and American Rural Sports, first 5 *numbers.*

By James Rowland, Jr.

Elements of Chemistry, by M. J. A. Chaptal.

Physical and Chemical Essays, translated from the Original Latin of Sir Torben Bergman, by Edmund Cullen, M. D.

A System of Practical surveying.

By James Mease, M. D.

Archives of Useful Knowledge, 3 *vols.*

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

Recueil Industriel, for November and December, 1830.

Bibliothéque Physico-economique, for January and February, 1831.

Annales de Chimie et de Physique, for October and November, 1830.

* The difficulty upon this subject is to bring the coal and the tobacco together; they are the products of different regions, and where tobacco grows wood is plentiful and will be used.—EDITOR.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for October and November.

Programmes des Prix proposés by la Societé d'Encouragement pour l'Industrie Nationale, pour être Décernes, en 1831, 1832, 1833, *et* 1835.

Annales des Mines, No. 3, Vol. 7.

American Annals of Education and Instruction, for May.

Magazine of Useful and Entertaining Knowledge, for April.

Ladies' Book, for May.

Casket, for May.

The Southern Review, for May.

Southern Agriculturist, for January, February, March, April and May.

Museum of Foreign Literature, Science, and Arts, Vols. 14, 15, 16, 17, and Nos. 1, 2, 3, 4, 5, of vol. 18.

The chairman of the Committee on Inventions stated, that the committee had been engaged during the past month in examining several inventions submitted to them, and reports on some of them would be prepared to be submitted to the Institute at their next meeting.

Professor Johnson made some remarks on the subject proposed for discussion this evening, viz. on the best mode of securing the boilers, cylinders, and all other parts of steam engines against loss of heat by radiation and conduction, when it was on motion continued as the subject for the next meeting.

Dr. Hays rose, and after some prefatory remarks, stated in substance as follows. That an attack upon the scientific reputation of Dr. Godman, late Professor of Natural History in the Institute, having been made very recently by a lecturer on Geology, in a public lecture delivered in the hall of the Institute, at which many members of the Society were present; and that a thorough investigation of the subject having resulted in a complete refutation of the attack, he thought it would be interesting to the members of the Institute to be put in possession of the facts upon which the vindication of their late Professor rested.

The lecturer before alluded to, had stated to his class that the animal described by Dr. Godman as new, under the name of *Tetracaulodon Mastodontoideum*, was nothing more than the young of the common mastodon. In support of this, the lecturer had exhibited two lower jaw bones from the collection of the American Philosophical Society, one of which he stated to be that of a young animal, and showed the socket which had once contained the tooth characteristic of the animal described by Dr. Godman, while the other, which he said was that of an adult, was asserted by him to have contained no such socket. The lecturer had also exhibited a tusk which he said was the milk tusk of the young of the gigantic mastodon.

Doctor Hays proceeded to say, that the jaw exhibited by the lecturer as that of a young animal, had proved, on examination, to be that of an adult, as the dentition clearly showed, while in that admitted by the lecturer to be the jaw of an old animal, the remains of the socket

which had once contained a tusk was clearly to be seen. And further that the tusk exhibited by the lecturer as a milk tusk, was evidently that of an old animal.

Dr. H. stated that he had communicated to the American Philosophical Society, the proofs of the accuracy of the preceding statement.

A. D. Bache, *Chairman.*

J. Henry Bulkley, *Rec. Sec.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1831.

With Remarks and Exemplifications, by the Editor.

1. For making *Rifles for the sharpening of edge tools;* and a composition for polishing of all kinds of metals; Peleg Barlow, Amenia, Dutchess county, New York, March 1.

A machine is to be used for putting the composition which is employed, upon wooden strips, called rifles; there is to be one composition for grinding, and another for polishing. The machine to be used is particularly explained and distinctly claimed, but there is no drawing of it. The rifles are as follows:—

"For grinding. *Two* parts of white lead, ground in linseed oil, and *three* parts emery. Linseed oil to be added to the mixture in sufficient quantity to make a paste of suitable consistence. Before the paste is spread upon the rifle, a composition of white or red lead and linseed oil, to be applied to the rifle, and dried, before the paste, or cement is spread upon it."

"For polishing. *Two* parts of white lead ground in oil, and *three* parts of red oxide of iron.—To the mixture for polishing, oil in like manner to be added, until the composition becomes of a suitable consistence."

On turning to Vol. 4, p.175, it will be seen that a patent was obtained by Beriah Swift, living in the same county with Mr. Barlow, for *a rifle for sharpening scythes and other edge tools;* dated June 11th, 1829, which we have thus described.

"Emery, of suitable size, is to be fixed upon properly shaped strips of wood, by means of a mixture of oil, paint, and varnish, which, when dry, forms the substitute for the stones usually employed."

The validity of either claim may admit of some doubt, and it certainly would have puzzled the last patentee, to have distinguished his invention "from all other things before known."

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2. For *making Axes by Machinery;* being an improvement upon the apparatus called the "oval axe machine;" Stephen Hyde, Williamsburgh, Hampshire county, Massachusetts, March 2.

The original machine was patented on the 29th of January, 1830,

and the present application is for an improvement upon the apparatus then claimed. Two dies, different in form from those originally used, constitute the present claim; they consist of an upper and lower die, and are intended for spreading the iron the width of the axe, and forming the lower part of the eye.

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3. For an *Improvement in Lamps,* by applying the principle of the Argand lamp, to the common wick lamp; Lewis F. Gallup, Woodstock, Windsor county, Vermont, March 3.

(See specification.)

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4. For a *Stove for burning Anthracite* and other fuel; Stephen C. Roe, New York, March 5. Patent assigned to James P. Allaire, of the same place.

The whole description is comprised in the following words.

"The stove is in the form of a truncated cone, terminating below in a cylinder; the top joined to a hemispherical cup, covered by a lid; or the cone may be without the cup. The pipe is joined near the top."

"What I claim is the conical form of the main body of the stove."

The drawing represents the stove described, both with and without the cup above mentioned. There is no fire-place door, the fuel being put in at top, by removing the lid. The cylindrical part extends no higher than is necessary to form an ash pit, the part containing the fuel being included in the cone.

These stoves are, we believe, made of sheet iron, and lined with fire clay, and usually of very small dimensions, say 18 inches in height, and perhaps 6 or 7 in diameter at the base. They are certainly very simple in their structure, and we are told that the anthracite burns better in them than in stoves of any other form, and have no reason to doubt the correctness of the information.

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5. For an improvement in *Locomotive Carriages, and Rails adapted thereto;* Emmor Kimber, Kimberton, Chester county, Pennsylvania, March 5.

(See specification.)

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6. For an improvement in the mode of *raising Vessels out of the Water;* Joshua Cleeves, Elmira, Tioga county, New York, March 5.

It is proposed in this patent to raise a vessel perpendicularly, by means of levers. Wharves are to be built, forming a slip into which the vessel to be raised may enter. A strong frame is to be made, like a raft. This is to fit in between the wharves, and to be the platform upon which the vessel is to be supported. The frame is to be sunk so that the vessel may float in over it, and then be secured upon it in a vertical position, by proper bilgeways, &c. Along each side

of the platform vertical pieces of iron rise so as to project above the wharves, where they are to be operated upon by levers, which, it is stated, may be attached, and put into action, in various ways; there are to be poles, or other contrivances, for securing the uprights as the vessel is raised. When the platform has been elevated as high as low water mark, or to the height intended, sliding pieces of timber, ranged in each wharf for the purpose, are to have their ends pass under the edge of the platform to sustain it and the vessel thereon. The whole is described in very general terms, and no claim made. We apprehend that in a practical essay, with a large vessel, the raising with levers would present difficulties which would prove this mode to be very inferior to that of the screw dock, for which it is intended as a substitute.

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7. For a *Knitting Machine;* John M'Mullin, and Joseph Hollen, Jr., Huntingdon county, Pennsylvania, March 5.

The machine for which this patent is taken manifests an uncommon degree of ingenuity on the part of the inventor. There is a working model of it deposited in the patent office, which we have seen in operation, and although not executed in a workmanlike manner, it operates sufficiently well to remove all doubt respecting the goodness of the work which it may be made to execute. The different parts of the machine are set in motion by the turning of a crank. The loops, or stitches of the article to be knit, hang upon pins, or teeth, which partially surround a horizontal wheel, and project upwards like the teeth of a crown wheel; the stocking is knit by it with the seam open, as in the common stocking frame. When the stitches have extended to a sufficient width, the motion of the crank is reversed, and the wheel is thus moved in an opposite direction.

We had thought of giving the specification, with an engraving of the machine, but shall not do this at present. Although we have spoken highly of the skill of the inventors, we do not believe that the machine will ever come into general use. In rapidity of execution it will fall far behind the stocking loom, and will not probably far exceed that of an expert knitter; besides this, it will be costly in the first instance, will be liable to disarrangement, and require more skill to repair it, than is usually found in country places.

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8. For a *Thrashing Machine;* Joseph C. Gentry, Kensington, Philadelphia county, Pennsylvania, March 7.

We cannot afford room for the description of this machine, as it resembles so many others. The claim is as follows.

"What I claim as my invention is the twisted reversed screw auger whippers, and the twisted reversed square edged iron bars which form the circle over which the cylinder revolves, and the improvement in the frame or case through which the wind and dust produced by the velocity of the cylinder escapes."

9. For an improved *Block for Stereotype Plates;* Bradbury Hackett, Boston, Massachusetts, March 8.

The general structure of this block is like those commonly used, having fixed lips or catches on one edge, and moveable, or sliding catches on the other. The two sliding catches are forced up against the edge of the plate simultaneously by turning a key which fits on to a pinion. The teeth of this pinion act upon a sliding plate, each end of which forms a wedge, these wedges acting upon the two sliding lips, force them up. There is a spiral spring upon the shanks of the sliding slips, which force them out when relieved by turning the pinion, so as to withdraw the wedges. Some other modes of moving the wedges are described, and considered as included in the general principle.

The claim is "to so much and such parts of the machinery above described, in combination, as is or may be employed by moving the moveable lips to or from the stereotype plates, at one operation, by inclined planes, or wedges and springs, acted upon by a rack and pinion with a key, or in either of the ways mentioned; and the moving of the moveable lips to or from the stereotype plate at one operation."

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10. For a *Thrashing Machine;* being an improvement in Douglass' Thrashing Machine; Fayette Cross, Sweden, Monroe county, New York, March 8.

As this thrashing machine resembles nearly all those which have preceded it, and is, we suppose, exactly like that of Mr. Douglass, except in the parts claimed, we proceed to furnish these distinguishing characteristics, which are thus set forth.

"The improvement which I claim, is, the introduction of winged gudgeons on the end of the cylinder, which is fastened to the gudgeons by iron wedges; and I also claim the invention of the rakes as represented."

It so happens that "the rakes as represented," are not to be found in the drawing; so that however excellent and original this part may be, we are not enabled to pass upon it the commendations it may merit. Should it prove equal, in point of *invention*, to the application of winged gudeons in the ends of the shaft, we shall be at a loss to find any terms in which we can express our admiration of it.

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11. For a mode of *Propelling Rail-way Carriages;* Abraham Pawling, city of Philadelphia, March 9.

This patent is taken for a very complex mode of communicating the power applied to a vertical shaft, by a crank, or lever, to the propelling of a rail-way carriage. A wheel, or pulley, is fixed upon a vertical shaft, and from this, endless chains or bands pass round pulleys on the axes of the wheels. There are tightening pulleys to preserve the tension of the band, or chains. The grooves on the wheels upon which the chains run, are furnished with what are call-

ed clasps, or springs, which it is apprehended will have a favourable effect on the chain which passes over them. The claim is to the clasps with joints and springs, or screws and bolts, for preventing the chain, or band, from slipping; and the position, combination, and the general arrangements of the parts thereof, for producing the desired result.

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12. For *Manufacturing Malleable Iron;* Seth Boyden, Newark, Essex county, New Jersey, March 9.

"*Specification.* The improvement consists in mixing rosin, pitch, or tar, with bituminous coal, and applying it as fuel for melting and converting crude or pig iron into malleable castings. The coal is pulverized, or broken in pieces of the size suited to the furnace grate, and mixed with rosin, pitch, or tar, in a proportion as the intense heat is desired, and applied in quantities diminishing in proportion as the rosin is increased."

SETH BOYDEN.

The foregoing contains the whole of the specification; the flame produced will undoubtedly have the effect of keeping off atmospheric air, and in this way protect the metal from oxidation. We do not perceive any other principle upon which it can operate in producing the effect of rendering the iron malleable.

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13. For an improved mode of *applying Water to Water Wheels;* Joseph Michener, Clinton county, Ohio, March 9.

The wheel used is the common flutter wheel, which is to have eight buckets. The wall of the dam is not to be built vertically, but is to incline two inches towards the wheel. The water is to pass through a funnel, or opening, above the wheel. The arms supporting the buckets are not to form radii with the shaft of the wheel, but are to be set back, to prevent the water falling in towards the shaft. The water is to act upon three buckets at once.

"I claim the setting of the arms back, which prevents the water falling towards the shaft, which will give more power on the wheel; also the inclination of the breast of the dam; and also the fall funnel, and applying the water, or action of three buckets at a time."

Brief as we have been, we have used more words than the patentee in his whole specification, wishing to enable our readers to perceive the whole merit of his invention.

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14. For an improvement in *Gas Metres;* H. Robinson, Boston, Suffolk county, Massachusetts, March 10.

The object of this improvement is "the introduction of water from the reservoir to the metre at the water line of the metre, by which means the water in the metre is kept at an equal height, though the pressure of the gas in the metre be ever so variable. Also the excluding of the water of the metre and reservoir from the atmosphere,

and thereby preventing the offensive odour that would otherwise be exhaled from it."

It is unnecessary to describe the particular mode in which this is done, as it would not be intelligible without a drawing, and would interest but few of our readers. A patent was obtained on the 11th of June, 1830, by HenryB. Williams, of Baltimore, for a method of effecting the same object, under the erroneous title of an improvement in gasometers.

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15. For manufacturing *Cast Iron Door Knockers, with Brass Plates;* Increase Wilson, New London, New London county, Connecticut, March 11.

The specification is in the following words.

"The usual mode, heretofore, of manufacturing cast iron door knockers, with brass plates, has been to fasten on the brass plates after the knockers are cast, by means of solder, screws, or rivets. My improvement consists in casting the knockers directly on the brass plates; which may be done by first casting the inside of the brass plates with tin, lead, or other metals which fuse at a lower temperature than brass. The brass plates are then secured in their proper place in the moulds, and the iron poured in, (as is usual in casting iron,) which will readily unite to the brass plates, and secure them on more firmly, and better than is done in the usual way with rivets, &c. INCREASE WILSON."

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16. For a machine for *Cutting large Wooden Screws,* for pressing hay, tobacco, cotton, &c.; John Morrison, Hardingsburg, Dearborne county, Indiana, March 12.

This machine is no other than the screw box commonly used for cutting bench screws, and screws of wood generally. The patentee, although he talks of "having invented," says at the close of his specification, "all I claim as new, and as my invention, is the augmenting and modifying the small screw cutting principle, so as to cut large wooden screws, without injury, and placing it perpendicular so as to apply power sufficient to cut it with one going over."

We know of nothing more easy than to become an inventor, if making an old and well known instrument somewhat larger than ordinary can give a claim to this title.

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17. For a machine for *Separating the Knots, Knobs, &c. from the Pulp used in Paper Making,* before the sheet is formed; and also for graduating the quantity of pulp necessary to form the sheet; Solomon Stimpson, Newbury, Orange county, Vermont, March 12.

The machine for clearing the pulp, consists of a tub, which may be 2 feet in diameter; within this is placed a metal cylinder, or curb, which fits close to the bottom of the tub. This may be twenty inches in diameter, and eight inches in width. Around the upper edge of

it there are longitudinal openings to admit the pulp to pass through. The pulp is pumped up from the chest, and is admitted through a tube into the inside of the curb. Arms with dashers revolve within this curb, and drive the pulp against the openings where the finer parts pass through, whilst the knots are retained. A spout leading from the space between the curb and the tub, conducts the prepared pulp, to form the sheet. There is a cover to the whole to prevent the pulp from being dashed over.

To regulate the quantity of pulp which shall be supplied, the tube which conducts it into the curb, is in the form of a funnel; the pulp pumped into this keeps it filled, and any surplus runs over, and back again into the chest. A stop cock in the tube, between the funnel and its inner end, regulates the quantity which shall pass in.

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18. For a *machine to be attached to a common Loom, for Weaving Figured Cloth;* George Deterick, of Lansing, and Jonathan Conger, of Groton, Tompkins county, New York, March 12.

This machine is to be placed in a room above the loom, to which it is connected by means of ropes and treadles; pins are so placed in a cylinder, or board, as to form the intended pattern, and operates in a way very similar to the apparatus well known to weavers; but which would be intelligible to few others even with the assistance of the drawing.

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19. For a *Machine for Grinding Apples;* Silas Freeman, Jr. New Marlborough, Berkshire county, Massachusetts, March 14.

This machine consists of a hopper to contain the apples, and against the lower part of which revolves a wooden cylinder, surrounded by rows of teeth; the feeding may be adjusted by a screw.

The claim is to "the insertion and forming on the *outermost surface* of the cylinder, rows of teeth in the manner described." At some period or other this mode was undoubtedly new.

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20. For an apparatus for *Preventing the Bursting, Collapsing, or overheating of Steam Boilers;* William A. Turner, Washington county, North Carolina, March 15.

To prevent the bursting of the boiler, "a large oblong square hole is to be cut in the top of the boiler;" this hole is stopped by a sliding shutter or door of iron, which is confined in a frame of iron surrounding the opening. This door forms a plane inclined to the top of the boiler, and slides in grooves in the manner of a sliding valve. According to the description given, this door is to be opened by levers connecting it with the safety valve, which, therefore, must open previously to the opening of this door.

To prevent the boiler from becoming overheated, there are to be metal rods passing through stuffing boxes in the top of the boiler, these metal rods are to be pressed down by weights, their ends in

the boiler are sustained by fusible metal supports, and when these melt, the rod descends, acts upon levers which turn a number of cocks, all admitting water on to the fire.

A valve opening inwards is to admit air as the boiler cools, and thus prevent collapsing.

We cannot follow the description through the long array of levers and other appendages specified and figured, unless we were of opinion that the proposed end was likely to be obtained by these contrivances; willing as we are, we cannot, however, stretch our faith or hopes so far. There is no claim made to any particular part.

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21. For an *Edging Machine*, or "French horse," *for turning the Edges of Tin, copper, or sheet iron*, for roofing; John Woolley, city of New York, March 16.

The improvements made upon this machine do not stand sufficiently alone in the specification to enable us to distinguish them clearly. One, however, is stated to be the preventing of the closing or flattening of the ends of the bend first formed, by the subsequent bending of the other sides. This is effected by providing grooves in the machine into which these first formed edges pass.

The claims made are rather vague in their character, such as the privilege of varying the machine, and constructing it of different materials. But there is one claim which certainly belongs to another subject, as it makes no part of the edging machine. It is as follows.

"The subscriber claims the privilege of forming metal roofs in such a manner that they effectually resist the driving of rain. This is done by inserting a small piece of metal, (which has been previously bent by his machine,) over each notch in the corners of the sheets; these are to be locked in with them on the roof. These pieces may be secured by nails, and not being exposed to the water, are not so liable to rust. The old practice of driving nails through the sheets is thus dispensed with entirely."

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22. For an improvement in the *Boiler and Furnace for Steam Engines;* Samuel Forbes, city of New York, March 17.

This consists of a furnace within a vertical boiler. A principal feature of the invention is the causing the bars that form the grate of the furnace to rise in a conical form, which greatly increases the surface by which the fuel is exposed to the action of the air. These bars all meet in the centre of the furnace, rise there above the surface of the fuel, and are surmounted by a cap, perforated with holes, to admit atmospheric air to mingle with the combustible gases extricated from the fuel, and thus to perfect their ignition. The claim is in the following words.

"What I claim as my invention is the particular mode of constructing the fire-place, with the grate rising conically, within a conical cavity. The cap piece for supplying air to the combustible gases. The mode of heating the fuel, and of supplying it to the fur-

nace from the cylindrical chamber; and the general arrangement of the whole for the attainment of the ends proposed."

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23. For an improvement in the *Grist Mill;* Joseph Yeamans, Ashtabula, Ashtabula county, Ohio, March 18.

This is another portable mill, in which the upper stone is to be the runner, and to be about 18 inches in diameter. The principal, and we believe the only difference between this machine and some others, is the manner in which the stone is held down. This is effected by the form given to the foot of the spindle, which is turned so as to have a neck in it a little above its point, or step. Two plates of metal, forming a collar, embrace this neck, and are screwed on to the bridge tree; there is consequently no loading necessary to the stone, as the bridge tree may be made to draw it down with any desired degree of force. There is no claim made.

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24. For an improvement in the construction of *Lamps;* John W. Schulze and Joel Trull, Medford, Middlesex county, Massachusetts, March 19.

It is intended by this invention to adapt the argand burner, to lamps of the ordinary construction. The interior as well as the exterior of the flame being supplied with air. The wick is divided into three or more parts, each having its appropriate tube. These tubes, *a*, &c. are segments of an ammulus, or ring, and when placed together assume a form resembling that containing the wick in the argand lamp. An opening is made in each tube for picking up the wicks, as in the common lamp. The air is admitted to the outside of the flame, under the glass burner, it being elevated upon knobs for that purpose; and to the inside of the flame through the spaces, *b*, &c. between the tubes, they not being in contact with each other. The three separate flames are made to unite in one, by a conical ferule, or ring, placed just above the tubes; this inclines the flame inwards; the inner current of air is thrown upon the flame by means of a button. The apparatus is ingeniously contrived, and well described. We are somewhat apprehensive that the interior current may prove insufficient for perfect combustion, but suppose, that on this score, the patentees have satisfied themselves by experiment.

The particular construction of such parts as appear to be new, are claimed, with the mode of combining them with those before known and used.

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25. For an improvement in the construction of *Trusses for Ruptures;* Jesse C. Earle, Baltimore, Maryland, March 19.

The principal object aimed at in this truss is to adjust the pad with great exactness, so that it may have the desired bearing. The pad is supported on an arm attached to the main spring of the truss. It is fastened to this truss by a screw in its centre, affording the

means of removing it from one part of the arm to the other. The arm swivels upon the point by which it is affixed to the main spring, allowing the pad to be turned downwards, or upwards, or to assume any other direction required.

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26. For a *machine for manufacturing Boots, or Shoes,* with nails or pegs; Nicholson Millis, city of New York, March 21.

This machine has a frame with two uprights, between which uprights there is a sliding piece, operating as a ram, or driver, to strike upon a moveable piece below it; under this is placed the leather or shoe, to be acted upon. A shaft, turned by a crank, carries wipers which lift the sliding piece, and allow it to fall. The soles are to be cut out by a steel knife bent in the form required for that purpose. The holes are all to be punched at once by means of a circular rim, having points instead of cutting edges. The nails, or pegs, after being placed in the holes, are also all driven home together, the bottom of the last being covered with iron, or other hard metal, to turn or clench their points.

There is no claim made to the machine, but to "the privilege of substituting cog wheels for band wheels; of constructing the machine of wood, iron, or any other suitable metal," &c.

The cutting and punching apparatus have been long used, although not operated upon by a machine exactly like that here described.

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27. For an improved *Auger,* called the serpentine screw auger; George Shetter, York, York county, Pennsylvania, March 21.

A patent was obtained by the same gentleman for the *serpentine screw auger,* on the 10th of September, 1829. The thread of this auger is not formed by twisting, but in the manner of those cork screws which have a continued shank, or shaft, or, in fact, like common wood screws. The difference between this and the auger formerly patented, consists in its having a double bit, or cutting edge, the other having had but one. This, it is said, makes it bore more easily and steadily than the original serpentine screw auger.

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28. For a *Thrashing Machine;* Abraham W. Summers, Gates, Monroe county, New York, March 21.

The cylinder of this machine has rows of teeth set along it, from end to end, and between each of these rows there is what the patentee calls a *float,* which is a piece of hoop iron set edgewise, and projecting about five-eighths of an inch from the cylinder. The hollow segment is formed of straight bars, set side by side, and presenting an acute angle to the cylinder. The patentee says—

"The principal features of this improvement are as follows. The placing of the floats between the rows of teeth, which prevent wet wheat or straw forming a wisp round the cylinder. The bars of the

concave made diamonting, and the acute angle placed within an eighth of an inch of the teeth, and so close together as to prevent the white caps passing between them. Thereby every kernel is compelled to pass over the whole concave, which clears it from chaff, and smut, and does not cut the kernel."

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29. For a *machine for Splitting, Shaving, and Cutting Leather, Skins, &c.;* Augustus S. Dawley, Boston, Massachusetts, March 22.

(See specification.)

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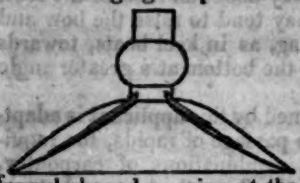
30. For an improvement in the *Chandelier, or Hanging Lamps;* William Lawrence, Meriden, New Haven county, Connecticut, March 23.

This hanging lamp has a reservoir, or chamber, in a form somewhat resembling that of the astral lamp now in such general use. This reservoir is composed of two shells soldered at their lower edges, and allowing a space between their upper edges for flat tubes with wicks to pass out. It is proposed, sometimes, to cover the funnel shaped opening at the lower edge with a pane of glass, capable of being removed for cleaning; the glass is represented in the drawing by the straight line at bottom.



"By this improvement much of the light of the lamp will be reflected and concentrated from the inner surface of the globe glasses, and pass diverging by means of the opening through the body of the lamp, and thus prevent the shadow of that, and cause an equal diffusion of light; they are peculiarly adapted to work shops, binacles, &c. and may be made of all sizes."

"I do not claim as my invention, the suspended lamp, the glass globed tubes, and the reflector in common use; nor the opening simply through the body of the lamp. But I do claim as my invention the means of making them altogether more useful than heretofore, viz. by the bell shaped opening of the well; the tubes for the wicks; the feeders; the bottom glass; and the mode of construction and suspension, as above described, and thereby its adaptation to produce the results specified above."

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31. For a mode of constructing *Wheel Carriages*, called "the rolling lever carriage;" Henry Chapman, Corinth, Saratoga county, New York, March 24.

For one, but not a first, account of this *invention*, we refer our readers to Vol. 4, p. 259, where it will be seen that a patent for an improvement in the application of wheels to carriages, issued to George Bridgman of Connecticut, on the 16th of July, 1829. As these improvements, so called, are identical, we shall not repeat

what we then said. The plan is to sustain the load upon a carriage with small wheels, and to allow the rims of those wheels to rest upon the insides of the rims of large wheels.

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32. For a *new Alloy, or Compound Metal, applicable to the Sheathing of Ships,* and other useful purposes; John Revere, M. D. a citizen of the United States, but now residing in England, March 24.

(See specification.)

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33. For an improvement in the construction of *Steam Boats, for the passage of rapids;* Thomas Blanchard, Machinist, Springfield, Hampden county, Massachusetts, March 28.

A boat to ascend rapids it is observed, should be wide at the bows, flat in the bottom, and rising gently, say about an inch in the foot, so that the current striking under it may tend to raise the bow and pass directly under the boat, not passing, as in keel boats, towards the sides. The stern should rise from the bottom at a greater angle than the bow.

"The construction of the boat designed by this applicant is adapted by its lightness and strength for the passage of rapids, the requisite strength being gained by skilful combinations of carpentry, consisting essentially in the support of the floor, the bow, and stern, by an arch extending from the extremity of the bow to the extremity of the stern. This arch may be constructed in many different modes of carpentry."

A mode of constructing this bracing arch is described at considerable length, and we are informed that "there are other modes of constructing the arch familiar to men skilled in the art and means of carpentry."

The boat is to be propelled by a paddle wheel, by means of a steam engine, with a horizontal cylinder.

"The principle of this improvement consists in the combination of a steam engine of adequate power, and convenient structure, with a flat bottom boat, having the bottom, bow, and stern, with the water wheel placed therein, as aforesaid, sustained and stiffened by an arch, substantially, as aforesaid, or by arches as hereinafter described."

There appears in the description of the distinguishing feature of this boat, a want of explicitness; the invention is not sufficiently tangible, and the patentee appears to be aware of this. He observes that "there have been heretofore flat bottom boats, and it may be that steam engines have been placed in them, with water wheels in the stern; but this applicant avers that no boat having a bow, bottom, and stern, of the construction aforesaid, and a water wheel placed as aforesaid, sustained and stiffened by an arch, or arches, of carpentry, had ever been invented, or known, and used, before this applicant invented his combination. This applicant having construct-

ed said combination, and put it in successful operation in the Allegheny river."

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34. For an improvement in the *mode of Mixing Paint;* Jonathan Linnell, Jr., Orleans, Barnstable county, Massachusetts, March 26.

(See specification.)

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35. For a *Machine for Pressing Bricks;* Archibald M'Clung, Fairfield, Rockbridge county, Virginia, March 26.

A firm bench is prepared, upon which lies a stout piece of timber capable of sliding backward and forward, horizontally, on the bench. Each end of this piece of wood is faced with iron, and forms a follower, or piston, by which the pressure is to be effected. The piston is moved towards either end by means of a lever, which, when the piston is in the middle of the bench, stands vertically; its upper part forms a handle, and upon its lower end there are teeth which take into teeth forming a rack upon the piston. There is an iron mould at each end of the bench, to receive a brick, and when the lever is drawn down to press a brick, at one end, it touches a rod, which, operating upon another lever, raises a pressed brick from the mould at the opposite end.

The claim is to "the machine for pressing bricks as before described."

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36. For an improvement in the *Loom for Weaving Webbing, Bed Binding, Tape, &c.;* Asa G. Bill and George Spalding, Middletown, Middlesex county, Connecticut, March 28.

Without the whole specification and drawing we cannot attempt an explanation of the improvements proposed, nor will the claims throw much light upon the subject. Those interested, therefore, must have recourse to the patent office for full information. The claims are to "the taking up of the goods as wove, by calender rollers.—The slanted or mortised lever for regulating the motion of the calender rollers.—The springing of the harness by rods.—The holding of the shuttle after it passes through the warp."

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37. For an improved mode of *Instituting and Drawing Lotteries;* James Kenny Casey, Baltimore, Maryland, March 28.

(See specification.)

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38. For an improved *Machine for Pressing Bricks;* John Sites, Harrisonburg, Rockingham county, Virginia, March 29.

In this machine the brick, contained in a suitable mould, is operated upon simultaneously by two pistons, one above and the other below the mould. A system of levers is so arranged that one of them shall act upon the upper, the other on the lower piston. The

particular arrangement adapted is not a subject for mere verbal description; the whole machine is claimed, the terms used being the same as those in No. 85.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in Lamps, by applying, in a new way, the principle of the Argand Lamp, to the common Wick lamp. Granted to LEWIS T. GALLUP, *Woodstock, Windsor county, Vermont, March* 3, 1831.

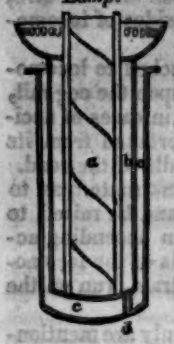
THE essential character of the invention consists in adapting the argand burner to lamps with imperforate bottoms.

To effect this, a cylindrical tube is constructed concentric with, and interior to, the wick, destined to convey the current of air through its centre, and this tube is furnished with a spiral groove upon its exterior surface, for the purpose of raising or depressing the wick, by a revolution of the tube which contains it, in precisely the same manner as the common argand lamp. The air tube, however, instead of terminating in an orifice at the bottom of the lamp, receives its current of air through a channel which opens beside the wick, at the top of the lamp.

The channel is furnished in either of the following methods. In the first the interior, or air tube, is to be enclosed in a second, which is concentric with it, and so much larger, that the intermediate space is sufficient for the reception of the wick and the moveable tube which contains it. This tube, as it is enclosed by a third, or exterior tube, may, for the convenience of description, be called the middle tube. The exterior tube is so much larger than the middle one, that the space between them is equal to, or greater than the capacity of the interior tube, so that the descending current of air, which passes through this space, furnishes a supply to the interior tube through which it ascends, as in the common argand lamp. The exterior tube is closed at the bottom, but descends far enough below the other to leave room for the current of air which passes around under the space between the middle and interior tube, and this space, which, as before remarked, contains the wick, is closed at the bottom by a circular zone, so as to prevent all communication between the air passage and the oil that supplies the wick. To supply the wick with oil, one or more tubes pass across the air passage, opening upon the inside of the middle, and outside of the exterior tube, to which tubes they are fastened by solder.

According to the second plan proposed for admitting the atmosphere to the bottom, the air tube itself is constructed just as before, except that it is closed at the bottom. The descending current of air is thus furnished by one or more tubes, which pass down by the side of the wick from the top of the lamp, and enter the bottom of the tube, to which they are joined by solder.

Gallup's Improved Lamp.



In both these cases, the ascending current of air which supplies the exterior of the flame, passes through a circular row of perforations in the flanch which supports the chimney of the lamp as in the common argand burner, and an air hole made through the lamp, or cylinder flanch, to let the air into the oil which surrounds the outer cylinder, or on the common argand principle.

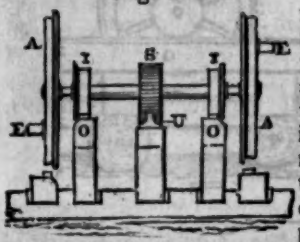
LEWIS F. GALLUP.

a, spiral tube interior to the wick.
b, space for the wick.
c, space for air to pass to the interior tube.
d, pipe for admitting air to the wick.

Specification of a patent for Locomotive Carriages, and Rail-roads adapted thereto. Granted to EMMOR KIMBER, *Kimberton, Chester county, Pennsylvania, March 5*, 1831.

THE invention consists principally in employing the power of locomotive engines on acclivities, in such manner, that by diminishing the velocity of its carriage, the effective force of the engine will be increased in the same ratio—thereby superseding the necessity of stationary engines.

Fig. 1.



A, A, Fig. 1st and 2nd, are the common wheels of a locomotive carriage, (3 feet in diameter,) to which the power of the engine is applied, by a wrist or crank at E, E. On these wheels the locomotive carriage runs upon a plane, drawing the train forward on the rails, nearly nine feet for every evolution. I, I, are two smaller wheels, (attached to A, A, or separate,) 1 foot in diameter, and placed upon the same axle with A, A. To ascend acclivities the locomotive carriage runs upon I, I, upon their own rails, O, O, raising the common wheels clear from their rails,—and therefore the carriage with the train moves forward only *three* feet for every revolution.

The diameter of the wheels, being as three to one, the engine employs three times as much power in a given space on the smaller wheels, as on the common ones—but the carriage and train move forward on the rails proportionably slower, and so of wheels of any other proportions, as four to one, five to one, &c.

On the middle of the fore axle is placed a cog wheel, S, of like diameter with the smaller wheels, to work free in the cog rail, U, to prevent slipping on great ascents. This use of the cog wheel is

known and has been variously proposed and tried. The improvement consists in substituting one cog wheel and its rail in the centre, in the stead of mixed rails, and cog wheels on both sides of locomotive carriages.

W, on Fig. 2, is a drag, or pall, that may be attached to locomotive carriages, and every car in their train to work upon the cog rail, U. Its use is well known to prevent a slip or slide in cases of accidents on great acclivities, but it derives new importance from its connexion with the cog rail, U, elevated in the middle of the road.

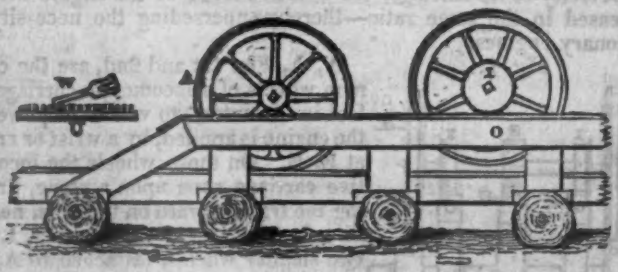
The ascending rails, O, O, and U, may be so constructed, as to rest upon the foundations with the common rails, and be raised to their proper height by blocks: they are only used in ascending acclivities, and for the small wheels. The hind wheels of the locomotive carriage, and the wheels of all the cars in the train, run on the common rails.

In this specification the wheels on the fore axle only are mentioned, because the power is considered as applied to the fore wheels. If the power should be applied to the hind wheels instead, or in part on both fore and hind, the principle would not thereby be changed. The small additional wheels on either, or on both, would be the application of power described and claimed as my invention.

EMMOR KIMBER.

Side View of Kimber's Rail-way and Carriage.

Fig. 2.



Abstract of the specification of a patent for a Machine for Splitting, Shaving, and Cutting Leather, Skins, and other substances. Granted to AUGUSTUS S. DAWLEY, *Boston, Massachusetts, March 22, 1831.*

THIS improvement rests upon a combination of machinery in a manner new and hitherto unused, to effect with ease, precision, and rapidity, the shaving, splitting, or cutting of leather, skins, and other substances, in any desired thickness, breadth, and length. Every piece of the machinery used in this invention may have been used before separately, and for other purposes, and the combination only is here claimed.

Fig. 1.

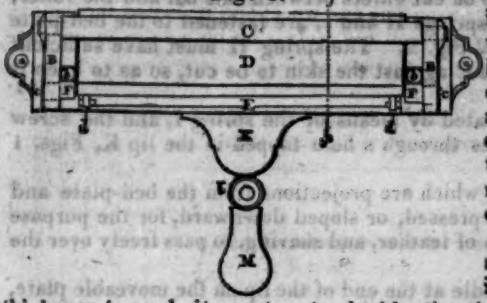


Fig. 1, in the drawing, is a perpendicular view of the machine in its place, as fitted for operation. Fig. 2, is a view of the back side of it. Fig. 3, is a section cut from front to rear at the place marked *f*, *f*, Fig. 1.

A, Figs. 2 and 3, is a bed-plate, of cast iron, increased in thickness towards its centre, to double the thickness of the other parts, in order to give it the strength necessary for the bearing of the screw by which the moving plate is moved on its pivots. At each end of the bed-plate is a screw hole, *a*, *a*, Fig. 1, to fasten the machine to a block or table.

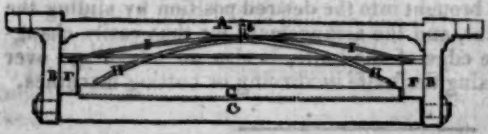
Fig. 2.

B, B, Figs. 1 and 2, are upright shoulders, on plates running across to sustain the machinery. C, Figs. 1, 2, and 3, is a polished wrought iron roller, turning freely on its axis, and supported by B, B. This serves as a gauge to regulate the thickness to which the leather or skin is intended to be cut. Its bearings may be so regulated that the roller may be brought nearer to, or removed farther from the edge of the knife at pleasure.

Fig. 3.

D, Figs. 1 and 3, is the knife, or cutting plate, fastened by nuts *b*, *b*, its edge resting nearly under the centre of the roller C.

E. Figs. 1 and 3, is the moveable plate, made as strong as the bed-plate. F, F, Figs. 1 and 2, are two shoulders, or upright plates on E, and of the same thickness and width; they lie within the upright plates on the bed-plate, and are fastened to them by the pivots *c*, *c*, Fig. 1. The shoulders of the moving plate move on their pivots to the extent required to vary the position of the edge of the knife. The motion of the moving plate and knife are effected by means of the screw J, and the spring I.

C, on Figs. 2 and 3, represents the shaving plate; its use is to guide the water part of the skin which is cut off, obliquely down from the edge of the knife. The front of the shaving plate, where it rests on the moveable plate, is secured to the shoulders on the moving plate by pivots, *d*, *d*, Fig. 1, on which pivots it turns freely. Its junction is shown also at *d*, Fig. 3. The back part of the shaving plate is nearly a square bar, and is supported by the spring, H, as seen in

Fig. 2. The leather to be cut enters between this bar and the roller, as seen Fig. 3. The springs H and I, are fastened to the bed-plate by a rivet, shown at *e*, Fig. 2. The spring H must have sufficient strength to sustain the C against the skin to be cut, so as to keep it against the roller.

The knife is graduated by means of the spring I, and the screw J. That screw passes through a hole tapped in the lip K, Figs. 1 and 3.

The lips, K and L, which are projections from the bed-plate and moveable plate, are depressed, or sloped downward, for the purpose of permitting the strip of leather, and shaving, to pass freely over the screw.

M, is a wooden handle at the end of the lip on the moveable plate, for convenience in handling the machine.

The leather introduced between C and G may be drawn through in any convenient mode.

It will be observed by inspecting the machine, that the knife plate is so fastened that it is impossible for it to slip back; and as the edge of the knife wears away, the screws or nuts are readily so adjusted that the edge may be brought into the desired position by sliding the plate towards the collar, and the arrangement for thus easily changing the position of the edge of the knife, is also an advantage over the former mode of fixing the knife in shaving or cutting machines.

Specification of a patent for an improvement in the mode of mixing Paint. Granted to JONATHAN LINNELL, Jr., *Orleans, Barnstable county, Massachusetts, March* 26, 1831.

TAKE one pound of unslacked stone lime, and add to it seven pints of warm water put these into an air tight vessel, and let them stand about two hours, or until the lime be well slacked, then separate the liquid from the sediment and put it into another air tight vessel. Take two ounces of sugar of lead and dissolve it in a pint of pure fresh water, and add this to the lime water. Then add linseed oil in quantity equal to two-thirds of the above mixture, and stir the whole well together till it forms a complete body, before mixing it with the paint.

The above composition is for *inside* painting.

For *outside* painting, take one pound of unslacked stone lime and put it into four quarts of warm water, and slack it as before. Dissolve two ounces of sugar of lead in a pint of clear fresh water, as before, and add to it the lime water; to this add linseed oil in quantity equal to the whole of the last mentioned mixture, and stir them till they form a complete body, and then mix them with the paint.

Amongst the advantages which this paint, mixed as above, possesses over common paint, is, that it requires no driers of any kind, and for a given quantity of work, less oil is required.

What I claim as my invention, and which I wish to secure by letters patent, is the mode of mixing paint as above described.

JONATHAN LINNELL, Jr.

Remarks by the Editor.—This patent is essentially the same with that of Mr. Metcalf, noticed at page 378 of the last volume. In that, soap and water were used, in this, lime and water, the effect of the lime being to convert a portion of the oil into soap. The remarks formerly made apply with equal force to the present patent, namely, that the effect will be to render the paint less durable, the binding property residing in the oil exclusively.

Specification of a patent for an improvement in the mode of Instituting and Drawing Lotteries, and of renewing and perpetuating them at pleasure. Granted to JAMES K. CASEY, *formerly of New York, but now residing near Baltimore, in Maryland, March* 28, 1831.

To all to whom these presents shall come:—be it known, that I, James Kenny Casey, Gentleman, have invented a new and useful improvement, being a mode of instituting and drawing lotteries, as well as renewing and perpetuating them at pleasure, without those excitements and appeals which are now so constantly resorted to, and which are alike injurious to the public morals and to the condition of the poorer classes of society, who should be assiduously excluded from all modes of enterprise inconsistent with their means and their duties.

This method of forming, drawing, and renewing lotteries, consists of any given number of tickets, or debentures, issued under the authority of any state government, for the benefit of the state, or of the general government of the United States, for the benefit of the nation, or otherwise, not inconsistent with the laws of a state, or of the United States.

And of this number of tickets, or debentures, a certain declared number shall be fairly drawn out of the whole mass, which shall each be entitled to the amount, or prize, which may be previously affixed to the order in which it is drawn: and this sum shall, without any delay or deduction whatever, be paid to the holder, less the amount of one ticket in the ensuing lottery with which the holder of the prize shall be furnished. Thus, if the ticket, from its number and the order in which it is drawn, be entitled to $100,000, the fortunate holder, (provided tickets cost $50 each,) shall instantly receive in cash $99,950, and one ticket in the then immediately ensuing lottery; and if his number only draws a $50 prize, he will only receive another ticket for the following lottery: and if his ticket be amongst the undrawn numbers, it will only be entitled to one-half, or thereabouts, of the original cost of a ticket; which proportion is only available towards the purchase of a ticket in the then ensuing lottery, by which means the drawing of one lottery always effects the sale of another,

as each ticket and each share of a ticket act separately, and are not entitled, by combination, to enter on a purchase in a new lottery; for instance, two undrawn halves cannot purchase one half, but each must act for itself, and the holder make up the balance in cash and buy two halves. Thus about half a million of dollars for the common security and the benefit of the state, or the nation, would always be in hand.

I shall now, for the purpose of making my improvement, and the principle upon which it is founded, and upon which it acts, more clearly understood, detail the particulars of the plan as it would exhibit itself upon a scale of 20,000 tickets, or numbers, each ticket at 50 dollars, and no share less than a quarter, which, of course, would cost $\$12\frac{50}{100}$. And here it may be necessary to remark, as the lottery, from its own nature, would spin itself out into endless duration, that if any ticket, or shareholder, were desirous of selling, either before drawing, or during the intervals of drawing, the market price would always be obtainable; and, from the clear, and decided superiority of the plan, there can be little or no doubt that the price of tickets and shares must always carry a very handsome premium.

20,000 tickets, or debentures, at $50,				$1,000,000
Off a small per centage—say 5,				50,000
For immediate distribution,				$950,000
1 prize of	$125,000		$125,000	
1	do. 100,000		100,000	
1	do. 50,000		50,000	
1	do. 40,000		40,000	
1	do. 12,050		12,050	
2	do. 12,000		24,000	
5	do. 10,000		50,000	
10	do. 1,000		10,000	
20	do. 500		10,000	
100	do. 100		10,000	
500	do. 50		25,000	
642 drawn				
19,358 undrawn	25		493,950	
				950,000

Of the drawn numbers, consisting of 642 tickets, the prizes may be assigned, in any amount, or in any order in which they may come from the wheel; for instance,

Amount for distribution without deduction or delay,			$950,000
1st drawn		$50,000	$50,000
10 next,	(2nd, &c.)	1,000	10,000
1	do. (12th,)	12,050	12,050
20	do. (13th, &c.)	500	10,000
1	do. (33d,)	125,000	125,000
250	do. (34th, &c.)	50	12,500
1	do. (284th,)	40,000	40,000

100	do.	(285th, &c.)	100		$10,000
5	do.	(285th, &c.)	10,000	-	50,000
100	do.	(390th, &c.)	50	-	5,000
1	do.	(490th,)	12,000	-	12,000
100	do.	(491st, &c.)	50	-	5,000
1	do.	(591st,)	12,000	-	12,000
50	do.	(592nd, &c.)	50	-	2,500
1	do.	(642nd,)	100,000	-	100,000
642	drawn,				
19,358	undrawn,	$25	-	-	493,950
20,000					950,000

The great advantage, and, indeed, what I shall call the chief glory of this plan is, that it must inflict a death blow upon all those schemes of morbid excitement, and of complicated fraud and treachery which have hitherto acted, without one moment's intermission, upon those who, from the poverty of their circumstances, and the desperation of their hopes, and calculations, are undoubtedly the least protected parts of society.

And should the public convenience, or interest, require a change of the scale, or amount, involved in the drawing, or in any way make it adviseable at any time to work out the old lottery, the same may be done at the termination of any drawing, by paying off in cash, both the drawn and undrawn numbers once every third year, or less, or more frequently, as it may seem just, or desirable. And, to avoid any loss from stolen, mislaid, or destroyed tickets, or shares, it is desirable that each purchaser of one or more tickets, or shares, should assign to the number, or numbers, thereof, a name as well as location, (real or imaginary,) to be registered, and mentioned, when payment is required.

In testimony that the foregoing is a true description of my improvement in forming, drawing, and continuing, or terminating and renewing lotteries, upon principles alike fair and intelligible, and with the hope of attracting those who now waste their time, money, and morals, at Faro-tables, or other places of unlicensed, improper, and unfair adventure, and to give to speculations of this kind, all the equality and justice of which from their nature they are susceptible, I have hereto set my hand at Baltimore, in the county of Baltimore, and state of Maryland, this first day of February, eighteen hundred and thirty. JAMES KENNY CASEY.

Specification of a patent for a new Alloy, or Compound Metal, applicable to the Sheathing of Ships, and other useful purposes. Granted to JOHN REVERE, *M. D. a citizen of the United States, but now residing in England, March* 24, 1801.

MY invention, or discovery, of a new alloy or compound metal, consists of zinc and copper combined in the following proportions,

viz. Zinc, ninety-five parts—copper, five parts, by weight. To form a complete union of these two metals in the above proportions, so that an alloy suited to the above named useful purposes may be formed, I find the following a convenient method. Having weighed out the above named metals, in the above named proportions, I proceed to melt them in separate vessels. As soon as the copper is melted, I add to it a part of the zinc. The precise quantity is not important, but I add as much zinc as the crucible will, conveniently, contain. I prefer to add the zinc to the melted copper, while it, (the zinc,) is in a solid state. By agitation, or stirring, and exposing them to a suitable temperature, I thus cause the copper, and a portion of the zinc completely to combine. A portion of the zinc being thus combined with the copper, as soon as the remainder of the zinc, contained in a different vessel, is melted, I add it to the zinc and copper, and by stirring cause as complete a union as possible of the zinc and copper, in the above named proportions. To prevent the combustion of the zinc, which is apt to occur when exposed to the temperature of melted copper, I, from time to time, throw into the vessel containing the melted copper and zinc, some flux, as charcoal pulverized, or common salt. As my object in doing this is to exclude the air and thus prevent the combustion of the zinc, I add a sufficient quantity to cover the surface of the metals. The alloy thus formed may then be cast into ingots to be rolled into sheets, formed into nails, or cast into any other shape according to the useful purpose for which it is designed. The above I find a convenient method of combining those metals, but any other may be employed which will effect as complete and equal a union as possible of these two metals, in the above named proportions. But it is not necessary that the metals should be exactly in the above named proportions, for any other proportions, not exceeding on the one hand, ninety-one parts, by weight, of zinc, to nine parts of copper; or, on the other, ninety-eight parts of zinc to two of copper, will produce a useful effect. But about ninety-five parts of zinc to five of copper, will be found the most convenient in practice. For it is to be observed that as the proportion of copper to zinc exceeds five *per centum*, the alloy becomes more brittle and more difficult to work; and as it falls short of five *per centum*, the power of the alloy to resist corrosion is proportionably diminished.

Finally, I claim in the above specification to have discovered that when zinc has, as above described, a small portion of copper combined with it, its liability to corrode is essentially diminished, and that the compound metal thus formed may be advantageously employed for the sheathing of ships, and various other useful purposes.

JOHN REVERE.

ENGLISH PATENTS.

Patent granted to JOSEPH HARRISON, *of Wortley Hall, in the parish of Tankersley, in the County of York, Gardener, and* RICHARD GILL CURTIS, *of the same place, Glazier, for certain improvements in glazing Horticultural and other buildings.—Dated 6th October,* 1830.

THE object of this patent is stated to be the giving a nearly even or plane surface on the upper side of the glass coverings of hot-houses, and other similar buildings.

The frame is furnished with a suitable number of bars, and they are both rebated on the under side for the admission of the panes of glass. A thin coat of white lead or putty is placed along the grooves, and the glass is fitted in, so that their edges overlap each other a little alternately at each end. A screw, (the head of which is supplied with a soft metal washer,) is inserted in the bars at the corner of the panes, and forms their support at this point, a piece of the glass being crumbled off to allow of the passage of the screw. Several small wedges are then driven into the framing, which are allowed to project a short distance, and complete the support of the glass.

Patent granted to HENRY CALVERT, *of the City of Lincoln, Gentleman, for an improvement in the mode of making Saddles, so as to avoid the danger and inconvenience occasioned by their slipping forward.—Dated 26th October,* 1830.

THIS improvement consists in attaching a spring or elastic plate to each saddle-tree point, which is effected in making up the saddle, and before it is what is technically called drawn on. The spring or plate is caused to project forward in a curved line from the tree-point, and bends slightly under the belly of the horse. The forward girth is buckled to the springs, and nearly touches the fore leg of the horse, and prevents the saddle from getting on the withers of the animal.

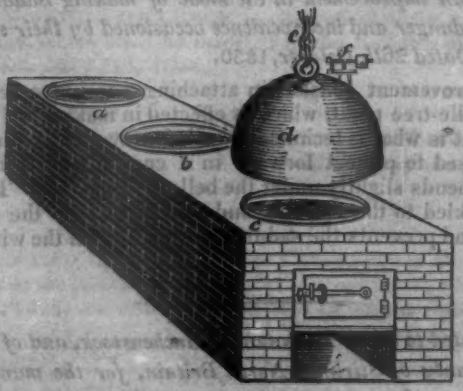
Patent granted to JOHN M'INNES, *of Auchenreock, and of Woodburn, in the county of Stirling, North Britain, for the manufacture or preparation of certain substances, which he denominates British Tapioca, and the Cakes and the flour to be made from the same.—Dated 24th April,* 1830.

THE patentee states his invention to be a manufacture or preparation of "bulberous-rooted" plants, indigenous to Great Britain, but more particularly the potatoe, from the strength of its mucilage, and its easy accessibility.

The roots, whether potatoes, parsnips, or beet-roots, are to be well cleansed and washed; they are then grated or mashed in the same way as in making potatoe starch, and the mucilage is passed through common sieves to separate it from the fibres; it is then exposed to the air to evaporate, and subsequently in a cast iron pan, which latter is placed on a fire to dry the contents thoroughly: these are constantly stirred to prevent their burning or sticking to the pan. When sufficiently dried it is ready to be ground, and is then suitable for the purposes to which flour is usually applied. It is observed by the patentee, that this is the same process he pursued for several years in the West Indies in the manufacture of Tapioca from the Cassada root, and that it will be found a very nutricious aliment either in conjunction with wheaten flour or separately.

To A. G. GARNETT, *of Demarara, Esq. a patent "for certain improvements in manufacturing Sugar," was granted on the 24th of July, 1830, and the specification was enrolled in the Enrolment Office on the 24th of January,* 1831.

THE principal improvement in Mr. Garnett's process, consists in the application of a dome-shaped iron cover, for the teach or concentrating pan suspended over it in such a manner as to be capable of almost instant application and removal, by which the process of supplying and removing the materials is greatly accelerated.



A perspective representation of this apparatus is here given: *a*, *b*, shows a series of clarifying pans, which are to be employed merely in the usual manner; and *c* represents a teach or concentrating pan with a dome-shaped cover, *d*, of cast iron, weighing about seven hundred pounds. This cover is suspended over the teach by a chain, *e*, which passes over a pulley and round a drum, or barrel, with a handle for raising and lowering the cover: *f* is a safety valve, through which the aqueous portion of the sirop escapes in the form of steam

through the safety valve. The cane juice having been clarified in the usual manner, is conveyed into the teach, and the cover applied; when the boiling, or evaporation of the aqueous particles will immediately commence and proceed with great rapidity: so that in the space of five minutes an additional quantity of sirop may be introduced, and in a few minutes more, a second supply will be required; and this continued for half an hour, when the teach will require to be employed and the operation recommenced. Therefore, the sugar in the teach may be changed every half hour: and as no time will be wasted in fitting the cover on the teach, much more work will be effected with the same labour and fuel. When the operation is completed the sugar is to be put into vessels of about six feet long, four feet wide, and two feet deep.

To M. Robinson, *of Great George Street, Westminster, a patent for "certain improvements in the process of making and purifying sugars," was granted on the 5th of August,* 1830, *and the specification was enrolled in the Enrolment Office on the 5th of February,* 1831.

This patentee applies his improvements to the purifying of the cane juice which is to be extracted in the usual way. He applies to the juice a saturated mixture of alum and lime, in the proportion of two pounds of the mixture to a hundred gallons of the juice. These being intimately mixed, the acid is to be neutralized by the application of milk of lime, in the proportion of three pounds to a hundred gallons. If there be an excess of acid it will be discovered by the application of the test paper usually employed by chemists to detect acids, and more milk of lime must be added; and if there be an excess of alkali, it may be discovered by the application of the test paper used for detecting alkalies, and more juice must be added. When the mixture ceases to effect either the test for acid or alkali, the impurities will be precipitated, and may thus be separated; and the juice thus purified is to be subjected to the usual mode of clarification and concentration; giving preference, however, to Howard's method. And the patentee claims as part of his invention, the application of steam heat to the evaporation of sugar in vacuo: using high pressure steam at about twenty pounds to the square inch.

Royal Ordinance of France, in relation to High Pressure Engines, (*May 7th,* 1828.)

(Continued from p. 406 of last vol.)

Charles, &c. &c.

Upon the report of our Minister of the Interior;

Having in view the ordinance of October 29th, 1823, in relation to high pressure engines.

By the advice of our Council of State;

We have ordered, and do order as follows:

Art. 1st. The proof-pressure prescribed by the ordinance of October 29th, 1823, is reduced, for boilers of copper or of rolled iron, to triple the pressure to which the boiler is subjected in the ordinary working of the engine. Manufacturers must give such thicknesses to boilers as shall enable them to bear the proof, without injury to the tenacity of the metal.

2nd. The boiler-tubes, for high pressure boilers, are subject to the rules prescribed for boilers, both in relation to proving and to inspection.

When the tubes are of a material requiring a different proof from *that of the boiler, they must be proved separately.*

In the contrary case, they may be proved with, or apart from, the boiler, as the manufacturer may wish.

In whatever way the proof has been applied, each boiler-tube shall be marked with a number denoting the working pressure of the engine, with the boiler of which the tube is to be connected.

3d. The cast iron cylinders of high pressure engines, and their jackets, must be proved at a pressure of five times that to which they are subjected in the working of the engine. After the proof, both the cylinders and jackets will be marked with the number denoting the ordinary working pressure of the engine.

4th. The pressure to be assumed as unity in determining the proof pressure, must be the bursting pressure to which the boilers, boiler-tubes, cylinders, and jackets, will be ordinarily exposed; that is, the whole working pressure diminished by one atmosphere.

5th. Our Minister of the Interior is charged with the execution of this Ordinance, which shall be inserted in the Bulletin of Laws.

Given, &c. May 7th, 1828.

(Signed,) CHARLES.

By order of the King.

(Signed,) DE MARTIGNAC,
Minister of the Interior.

Circular of the 1st of August, 1828, to the Prefects of Departments, in relation to the Royal Ordinances of the 2nd April, 1823, and of 25th May, 1828, concerning boilers used in Steam Boats.

SIR,—You are acquainted with the Royal Ordinance of 25th of May last, (Bulletin of Laws, No. 233, p. 497,) in relation to steam engines used in navigation.

An ordinance, bearing date April 2nd, 1823, prescribed certain regulations for steam boats; the subject required, however, more particular attention. In order the better to secure passengers and the crews of steam boats, as well as merchandise, against accident, it has been found indispensably necessary to place the *low pressure engines of steam boats,* and their boiler-tubes, under the operation of the rules prescribed by the Royal Ordinance of October 29, 1823, in

relation to *high pressure engines*, and by the ordinance of May 7, 1828, concerning the boilers and boiler-tubes of high pressure engines.

The use of boilers, or boiler-tubes, of *cast iron* on board of steam boats is prohibited.

The cast iron cylinders of the low pressure engines of steam boats, as well as their jackets, must be proved and marked in the manner prescribed by the ordinance of 7th of May, last, for cylinders, and their jackets, used in high pressure engines.

These are the principal particulars of the ordinance of May 25th, 1828. As they refer to the ordinances of October 29, 1823, and May 7, 1828, I can but call your attention again to the two sets of instructions which I had the honour to transmit to you on the 19th of May, 1825, and 16th of July, last, in relation to the execution of those ordinances. The table of thicknesses for wrought iron boilers, contained in the latter of the instructions referred to, may be used for the boilers now in question. In fact, that table beginning with two atmospheres, is applicable to low pressure boilers. It has not been deemed necessary to give the thicknesses corresponding to a working pressure of one atmosphere and a half, since manufacturers are in the habit of making boilers for so low a pressure thicker in proportion, than for higher pressures.

The Board of Inspection which you were required, by the 1st art. of the ordinance of April 2nd, 1823, to convene, will have new duties to perform. I trust they will see the importance of the new regulations, and will have them strictly executed.

I beg you to communicate to this board the instructions of May 7th, 1825, copies of which I again transmit to you, and of 12th July, last, annexed to my circular of the 16th of the same month.

I further request you to transmit these instructions to the proprietors of steam boats, and to the manufacturers of *low pressure engines for steam boats*, within your department.

They will see that the dies for marking the boilers may be had at the Royal Medallic Mint, Paris, and the fusible metal plates of M. Collardeau, &c.

I have thought it useful to transmit — copies of the ordinances of 2nd April, 1823, and 25th May, 1828, with the present circular. I request you to distribute the copies which I send you to those interested in the subjects of these ordinances.

The Engineers of Mines and of Civil Works are called upon to perform new duties. If I have required of them assiduity in their duties of inspection, and of you constant solicitude, in relation to the establishments where high pressure engines are used, I beg that they and you will take the same pains in the execution of the ordinance of 25th May, last, concerning *low pressure* engines used on board of steam boats.

It is evident that accidents to steam boat boilers, must be of great injury to industry; and more than this, painful to humanity on account of the number of victims, who, cut off from all means of

escape, must meet death by the waves, if they should not have been reached by the explosion.

I beg you, sir, to acknowledge the receipt of this.

I have the honour to be, &c. &c.

(Signed,) BECQUEY,
Counsellor of State, &c.

Royal Ordinance, (1823,) *in relation to Steam Boats.*

LOUIS, &c. &c.

Upon the report of the Minister of the Interior,

Having before us the law of 29th floreal, year 10, (19th May, 1802.)

Having also before us the decrees of the Prefect of the Gironde, of November 15, 1821, and March 27, 1823, in relation to the police of steam boats running upon the Garonne.

Having before us the observations and opinion of our Minister of Marine, of 27th August, 1822, upon the said decrees.

Having also the opinion of the Board of Civil Works of the 10th of October, following.

Considering that existing laws and regulations, applying to steam boats, do not give sufficient security to the crew and passengers, and that, therefore, it is necessary to resort to special regulations.

Considering, also, that it is important to establish, for the police of steam navigation already introduced upon several streams, general and uniform measures, leaving only to the local authorities the details flowing from these.

With the advice of our Council of State,

We have ordered and do order as follows:

Art. 1st. In all departments containing rivers, streams, or coasts, where steam boats may run, the Prefect shall organize one Board, or more, of practical men, to be presided over either by a chief Engineer of Civil Works, or, in his default, by an engineer of lower rank.

It shall be the duty of this Board, under the direction of the Prefect, to satisfy themselves that steam boats are of due strength, particularly in reference to the engine; that the engine is carefully kept in order, in all its parts, and presents no appearance of special liability to fracture, nor any dangerous deterioration.

2nd. No steam boat can be put in operation until after the Board shall have ascertained the strength of the parts and the good condition of the engine, nor until the Prefect shall have informed the proprietors that he has received and approved the report of the Board.

3d. The Board shall inspect quarterly every steam boat, and shall make a report thereon to the Prefect, in which shall be stated the measures to be pursued in case any defect should appear in the engine. Besides the quarterly visit of inspection, the Board shall make others, whenever directed by the Prefect.

4th. Steam boats are placed, in relation to the number of passen-

gers, the hour of starting, to the composition of the crew, and condition of the vessel, under the regulations in force upon the coasts, rivers, or streams, in relation to navigation. Consequently, when the boats navigate the waters of sea-board arrondisements, the captains must be provided with a permit, or register, and when navigating the waters of inland arrondisements, such boats shall be subject to the inspection of the port officers, as well as to regulations of the Prefect in relation to police at setting out and landing.

5th. The Minister of the Interior is charged with the execution of this ordinance.

Given, &c. April 2nd, 1823.

(Signed,) Louis.

By order of the King.

(Signed,) Corbiere,
Minister of the Interior.

Royal Ordinance in relation to Low Pressure Boilers, used in Steam Boats, 1828.

Charles, &c. &c.

Upon the report of our Minister of the Interior:

Seeing the ordinances of April 2nd, and October 29th, 1823, and of May 7th, 1828.

Wishing further to provide for safety in steam navigation by adding to the general and special regulations, already published, such others as experience has shown to be necessary.

With the advice of our council of state,

We have ordered, and do order as follows:

Art. 1st. The low pressure boilers, viz. those working at, or below, a pressure of two atmospheres, used in steam boats, as well as the boiler-tubes, are placed under the operation of the regulations prescribed, for the safety of the boilers and boiler tubes of high pressure engines, by articles 2, 3, 4, and 5, and the first paragraph of art. 7, of the ordinance of October 29, 1823, and by the ordinance of the 7th of May, 1828.

2nd. The use of cast iron boilers, on board of steam boats, is prohibited under every pressure.

3d. The cast iron cylinders, and their jackets of cast iron, used in the low pressure engines of steam boats, shall be proved and marked as is prescribed by the ordinance of May 7th, 1828, for the cylinders, and jackets, of high pressure engines.

4th. The preceding regulations as well as those of the ordinance of April 2nd, 1823, apply to stationary boats on board of which steam engines are used.

5th. The Board created by the ordinance of April 2nd, 1823, will attend to the execution of the preceding regulations and will make mention of the fact in their report.

6th. In case of infraction of the present ordinance the owners of

steam boats will be liable to the recall of their permits, without prejudice to the penalties which may be awarded by the courts.

7th. Our Minister of the Interior is charged with the execution of this ordinance, which will be inserted in the Bulletin of Laws.

Given, &c. May 25th, 1828.

(Signed,) CHARLES.

By order of the King.

(Signed,) DE MARTIGNAC,
Minister of the Interior.

Note upon the Method of Calculating the Thicknesses of Wrought Iron Boilers.

IN the preceding instructions, it was only necessary to give the formula for determining the thicknesses of wrought iron boilers; it has been deemed adviseable to state, in this note, the considerations whence this formula was derived.

It is supposed in what follows that the boiler is a cylinder with hemispherical ends. This form, it is well known, is the best for all boilers, and the only proper one for those of high pressure engines.

In order that a boiler of this form may be equally capable of resisting, at all points, interior pressures perpendicular to a plane passing through the axis of the cylinder, the hemispheric ends must have only half * the thickness of the cylindric part. In practice, the same thickness is, with propriety, given to the ends as to the cylindric part, since the sheets of metal used in forming the ends must be more injured in giving them the required form, than those constituting the body of the boiler. This being the case, it will be necessary to determine only the thickness required for the cylindric part of the boiler: this is given by the following formula.

$$t = \frac{d \times P}{2c} \ldots\ldots (a)$$

In this formula we obtain the thickness, (t,) in inches if the diameter of the boiler, (d,) has been expressed in inches. P is the whole

* Strictly speaking the thickness should be something less, but the difference is so small that it may be disregarded. Let t and t' be the thicknesses of two different boilers, the first being cylindric, the second spherical; all other things being the same in these boilers, and both in vacuo, we shall have

$$t' = t \times \left(\frac{-1+\sqrt{a+1}}{a}\right)$$

a representing the ratio between the bursting pressure for a given surface and the tenacity of the material for the same surface. In the case in which this force is 7 atmospheres, (of 15 lbs.,) or 105 lbs. to the square inch, and the tenacity 37840 lbs. for the same surface, then $a = .002774840145$, and

$$t' = t \times \left(\frac{-1+\sqrt{.002774840145+1}}{.002774840145}\right) = t \times .4995$$

interior pressure, and c the tenacity of the wrought iron, each being referred to the same amount of surface.*

This formula supposes the boiler to be in vacuo, but as it is pressed on the exterior by the atmosphere, the force tending to produce rupture is equal to the elasticity of the steam within, diminished by one atmosphere. Let p represent the pressure upon the unit of surface, and n the number by which the pressure of one atmosphere is to be multiplied to give the tension of the steam within a boiler; the pressure from within is np, that from without p. Consequently the bursting pressure upon a unit of surface is $np-p$, or $p\,(n-1,)$ substituting this value for P in the formula $(a,)$ it becomes

$$t = \frac{d \times p\,(n-1)}{2\,c} \ldots\ldots (b)$$

The thickness of a boiler calculated by this formula would be too small, since the tenacity of the metal would be just equal to the force tending to burst the boiler. It remains to determine the addition which must be made to this thickness, to suit the circumstances of the case.

To meet the requirements of the ordinance of May 7th, 1828, this value of t should be multiplied by three in order to produce an equilibrium with the proof-pressure, if this product be multiplied by three, the boiler will not be injured by the proof to which it must be subjected. Multiplying the second member of equation (b) by 3×3, or 9, we shall have

$$t = \frac{d\,p\,(n-1)\,9}{2\,c} = \frac{d\,p\,(n-1)\times 4.5}{c} \ldots\ldots (c)$$

If we take the square inch as unity of surface, $p = 15$ lbs.

In the case assumed, c represents the tenacity of rolled iron to the square inch; if the boiler were of copper, c would express the tenacity of the latter metal.

The tenacity of rolled iron is generally taken at 44,000 lbs. per square inch, which is the strength of iron of medium quality.

Below are the results of careful experiments upon the tenacity of hammered iron, of rolled iron, and of copper. The tenacities are referred to the same section, a square inch, and expressed in pounds and decimal parts of a pound.†

1. *Iron.*—The tenacity of very good forged iron was 63,730.7 lbs.

Iron of the same quality, but heated to dull redness the tenacity was - - 11,445.3 lbs.

So that the tenacity of this latter is but little more than one-sixth of that of cold iron‡ of the same quality.

* The thickness given by formula $(a,)$ corresponds to the only case which it is of importance to consider, viz. that in which the plane of rupture passes through the axis of the boiler. If we suppose the plane of rupture perpendicular to the axis, the case would refer itself to that of a spherical boiler, the thickness of which should, at most, be but one-half that of a cylindric boiler of the same diameter.

† These experiments were made by Messrs. Tremery and Poirier Saint-Brice.

‡ M. Cagniard-Latour was good enough to assist in these two experiments,

2nd. *Rolled Iron.*—Two experiments were made upon rolled iron of the best quality. The first gave for the tenacity of the rolled iron, - - - - - - 58892.5

The second, - - - - - - 56554.6

Total, - - - - - - 115447.1

Mean, - - - - - - 57723.5

3d. *Copper*—Sheet copper of excellent quality was submitted to experiment, its tenacity proved to be, - - - 38,217.6

It is usually supposed that the tenacity of copper is about two-thirds that of rolled iron, $38217.6 \times \frac{3}{2} = 57326.4$ upon this supposition, a number not much less than that obtained by the experiments, just given, upon rolled iron.

Now if in the formula (*c*) we substitute for *p*, its value 15, it becomes $t = \frac{d \times 15\,(n-1)\,4.5}{c} = \frac{67.5}{c} \times d\,(n-1) \ldots\ldots (d)$

It would seem that nothing remains but to substitute for *c* its value, in order to obtain that of the coefficient $\frac{67.5}{c}$. The remarks which follow will show that such is not the case, and that this coefficient must be determined by considerations of a practical kind.

The number given as that usually taken for the tenacity of rolled iron, viz. 44,000 lbs., would seem, from the experiments given, to be quite small enough. In practice, it is out of the question to take so high a tenacity as the basis of calculation.

In fact if we should make $c = 44{,}000$ in the formula for the thickness, we should have at low pressures, and with small diameters, thicknesses much too small, and the thicknesses would be rather small even for high pressures and large diameters. If we should diminish the value of *c* in order to have thicknesses which would suit the former of the supposed cases, we should obtain for the high pressures and considerable diameters, such extravagant thicknesses, that they could not be adopted in practice.

The difficulty arises from this, that in the formula reference is had to the force tending to burst the boiler which depends upon the tension of the steam within, that is, upon the value of *n*. In proportion as *n* is diminished, *t* diminishes also, and when $n = 1$, $t = 0$. This case is that of a boiler containing steam of atmospheric tension. Such a boiler is, of course, impossible.

In theory we may suppose sheets of iron to be diminished in thickness indefinitely; but such an idea is purely theoretical, and cannot be realized in practice. It is therefore necessary to set out with a certain thickness independent of the elasticity of the steam within

which were made at Clichy, in a laboratory where arrangements were making for the preparation of oil gas, for the purposes of illumination. The iron retorts in which the decomposition of the oil was to be effected were necessarily to be exposed to a dull red heat, and it was important to determine the tenacity of iron at the corresponding temperature.

the boiler, and also to add a thickness, which shall also be independent of the tension within, to make up for the loss of tenacity which the metal undergoes, in being bent, by the temperature to which it is exposed, and by wear. The least thickness which can be added to make up for these circumstances is .12 of an inch, ($\frac{1}{8}$th,) which must therefore be added to the thicknesses given by the formula.

We must now determine the value which $\frac{67.5}{c}$ should have in order that the thicknesses calculated by the formula and increased by .12 inch should suit all diameters of all tensions, and should agree, as nearly as possible, with the thicknesses usually given by the best manufacturers to their boilers, made to stand a long continued use.

It has been found that all these conditions may be satisfied by making $\frac{67.5}{c} = .0018$, which supposes for rolled iron a tenacity of 37,500 lbs. per square inch.

Substituting this value for the coefficient in formula (d,) and adding the constant thickness of .12 of an inch, we shall have

$$t = .0018\ d\ (n-1) + .12 \ldots\ldots (e)$$

It has been remarked above, that the tenacity of the best rolled copper proved to be 38,217.6 lbs.; this number is rather higher than that, (37,500,) deduced from the coefficient .0018 of the formula (e,) this formula, therefore, may be used to determine the thicknesses of copper boilers, a condition which it was important to fulfil, since, for the reasons set forth in the instructions, manufacturers usually give no greater thicknesses to copper than to iron boilers. As, however, the number 37,500 is but little less than that given by experiment for the best varieties of copper, and as the tenacity of certain varieties may be lower than this, it will be necessary, according to the quality of the copper, to increase the thickness given by the formula, by about one or two-tenths of the thickness found.*

It results from the remarks contained in this note that for different values of d and n, the formula (e) will give the thicknesses, by the comparison of which in any given case with the actual thickness of a boiler, it may be ascertained whether, or not, this boiler can withstand the required proof without injury. Manufacturers by governing themselves by these thicknesses will not throw into use boilers incapable of bearing proof, after long continued wear. In this way they will be preserved from the ill effects which would result, if their boilers were condemned, by the engineers, in the annual visits of inspection required by the 7th article of the ordinance of October 29th, 1823. T.

* According to George Rennie, the tenacity of hammered copper is but 36.531.6 lbs. per square inch.

On the First Invention of Telescopes, &c.—*By* Dr. G. Moll, *of Utrecht.*

(Concluded from page 336, vol. 7.)

Having heard what was adduced on the side of Lippershey, we must now turn to the witnesses of Zacharias Tausz, of Taussen.

The first of these is the ambassador Boreel himself, a man alike respectable for his rank, character, and abilities. He says, that in 1591, the year in which he, (Boreel,) was born, a spectacle-maker lived near his father's house at Middleburg; that this man's name was Hans, his wife's Maria, and that, besides two daughters, he had a son called Zacharias; that Boreel knew this Zacharias intimately, they having been playmates. This Hans, *i. e.* John, with his son Zacharias, as *Boreel often heard*, invented the first *microscope*, which was presented to Prince Maurice, and they obtained some reward. A similar *microscope* was afterwards offered by them to the Archduke Albert of Austria. When Boreel was ambassador in England in 1619, he saw that identical microscope there, in the possession of Cornelius Drebbel, of Alkmar, a man of much knowledge, and mathematician to King James, the Archduke having presented the microscope to Drebbel. This microscope of Zacharias was not, continues Boreel, as they are shown at present, with a short tube; but it was about eighteen inches long, and two inches in diameter, with a tube of gilt copper, resting on two sculptured dolphins; under it was a disc of ebony, on which the objects to be examined were placed.* But long after, in 1610, by dint of research, they, (*i. e.* Hans and Zacharias,) invented in Middleburg the long sidereal telescopes, with which we gaze at the moon, the planets, stars, and heavenly bodies, of which a specimen was given to Prince Maurice, who kept it secret, judging it useful in expeditions. However, as this admirable invention was rumoured about, and as curious men were talking about it in Holland and elsewhere, a stranger came from Holland to Middleburg to inquire into this matter, and, asking for a spectacle-maker, he was shown, by mistake, into the shop of John Laprey. He spoke with him about the secret of the telescope. Laprey, being an ingenious man, and a close observer, heard attentively what the stranger said, and thus, with laudable industry and care, became the second inventor of the long telescope, which he made to the satisfaction of the stranger. Therefore Laprey, who by his ingenuity discovered a thing which was not shown to him, deserves to be ranked as second inventor. He first sold telescopes, and made them generally known. Afterwards, Adrian Metius, Professor of Francker, and, later, Cornelius Drebbel, came to Middleburg in 1620, and bought each a telescope, not from Laprey, but from Zacharias Tausz.

From this evidence we may infer, that Hans, or John, and his son Zacharias, were actually the inventors of a compound microscope for opaque objects: the elegant ornaments of this instrument, and

* A stage.

the general description which Boreel gives of it, make it probable that both Hans and Zacharias were men of ability. But with microscopes we have at present nothing to do. The point at issue is, whether either Hans or Zacharias, or any body else, actually made telescopes before the second of October, 1608; and since Boreel indicates 1610 as the epoch of the invention of Hans and Zacharias, the claim of Lippershey to priority remains unshaken, even by the evidence of Boreel.

The following witness is John, the son of Zacharias, and consequently grandson of this Hans, of whom Boreel has spoken. He says, in 1655, that he then was fifty-two years old; thus, at the period when Lippershey sent in his petition, *i. e.* in 1608, he was only five years old. He does not mention his grandfather, but says, that his father, Zacharias, was the first inventor of the telescopes; and that this happened, as he *had often heard*, in this town, in 1590; but the longest telescope made at that time did not exceed in length fifteen or sixteen inches. He affirms that two such telescopes were *then* offered, one to Prince Maurice, the other to the Archduke Albert; and that telescopes of such length were in use till 1618. At that time, he, John, and his father, Zacharias, invented the construction and fabric of the longer telescopes, which are still now used at night to look at the moon and stars. He further says that, in 1620, a man of the name of Metius came to Middleburg, and procured such a telescope, the construction of which he afterwards tried to imitate; and he adds, that Drebbel did the same.

This witness, fixing the epoch of the invention at 1590, speaks only from hearsay. Besides, he is in contradiction with Boreel, who states that the invention of the telescope by Hans and Zacharias was in 1610, at which time Boreel was nineteen, and this John Zacharias only seven years of age. John says nothing of the microscope, which Boreel actually saw and described. It is certainly possible that one of the Metii, perhaps the Professor, came to Middleburg in 1620, and bought a telescope. But this does not decide the question of priority, as we know, from incontrovertible authority, that Jacob Metius was in possession of the invention in 1608. What happened in 1620, when so many splendid discoveries were made by means of the telescope, is not of the least consequence, as far as concerns the first invention of the instrument.

There still remains another witness, whose evidence is very immaterial and of little importance. It is a woman called Sarah Goedard; she is a sister of Zacharias Jansz: she merely says, that it is forty-two or forty-four years ago since her brother invented the long telescopes in Middleburg. She often saw her brother at work making telescopes; but she cannot speak positively as to time.

This woman's evidence, who brings the invention to 1611 or 1613, cannot be of the slightest use in settling the question between Zacharias and Lippershey.

It was then the soldier of Sedan, who first brought the instrument to France; but his endeavours met with no great success in that country. It is most astonishing to find the French philosopher Pei-

rese doubting the truth of the invention of telescopes at late as 1622, and ascribing it to Drebbel, a person wholly unconnected with it. In a letter to William Camden, he says, "I should like to know what is true about the inventions of Cornelius Drubelsius Alkmariensis, who, as is said, has invented in your parts a globe representing ebb and flood, a covered boat going between two waters, and long *spy-glasses, (lunettes,) with which a writing may be read at the distance of a league, which we do not easily believe here.*"*

And in another place† he says, "we are told marvellous things here about the invention of Cornelius Drubelsius Alkmariensis, who is in the service of the king of Great Britain, and who lives in a house near London; amongst others a covered boat, which goes between two waters; a glass globe, which he makes to represent the tides, by a perpetual motion, regulated like the natural tides of the sea, *and of a spy-glass which makes one read a writing at more than a league,* (or a mile,) *distance.* I beg you to write me a word about the truth of each of these inventions. We have here those small glasses, (lunettes,) by which insects and mites appear as large as flies, which is certainly admirable; but I should like to know what is true respecting these other inventions."

It would appear that the invention was attributed by some persons to the soldier of Sedan, whose name appears to have been Crepi.‡ He left, as we have seen, the Low Countries in December, 1608, and in May following, 1609, we find a Frenchman in Milan making telescopes. Sirturus§ gives us the following account of this transaction.

"A Frenchman hurried to Milan in May, 1609, who offered a telescope to the Count de Fuentes. He called himself a partner of the Dutch inventor. The Count gave the instrument to a silversmith, to have it included in a silver tube; it fell into the hands of Sirturus, who handled and examined it, and made a similar one, (if his assertion is to be believed;) but perceiving that much depended on the glass, he went to Venice to get some at the workmen."

Simon Marius, who disputed the discovery of the satellites of Jupiter with Galileo, speaks of another Dutch telescope, which came into foreign parts at a very early stage of the invention. He says that in 1608, at the autumnal Franckfort mass, or fair, (usually held in September,) a certain General Fuchs de Bimbach, an amateur of mathematics, heard from a Dutchman then at the fair, that an instrument had been invented which magnified objects and made them appear near. He wanted to procure one of these glasses, but the Dutchman asked too high a price; but being returned to Onoldsbach, Fuchs told the circumstance to Marius; adding that the instrument had two glasses, one convex and one concave, of which he even drew the figures. Marius adjusted glasses of this form, and convinced himself, to a certain point of the possibility of the thing; but his ob-

* Gul. Camdenii et ill. viror. ad Camden. Epistol. London, 1691, p. 333.
† Page 387.
‡ Borel de verotelescopii inventore, p. 19.
§ Sirturus de telescopio, Edit. Frankf. 1618. 4to. minori, p. 25.

ject glass was too convex. He ordered some other glasses of the opticians of Nuremberg; but he could procure none that suited his purpose. The next summer, of 1609, Fuchs got a tolerable instrument from Holland, which he used with Marius in examining the heavens. About the beginning of 1610, Fuchs got two well polished glasses from Venice, where they had been worked by T. B. Lanccius, recently returned from Holland.

If the account of Marius deserves credit, the person who brought the telescope to the Franckfort mass, or fair, in September, 1608, did so a short time before Lippershey presented his petition to the States, which was done the 2nd of October of that year. Fuchs, certainly with great reason, thought the Dutch telescopes high priced; we have seen Lippershey asking a thousand florins for one.

We are indebted to the English author of the *Life of Galileo* for an instance of another Dutch telescope being brought to Italy. Lorenzo Pignoria writes to Paolo Gualdo, from Padua, the 31st of August, 1609, "We have no news, except the return of his Serene Highness, and the re-election of the lecturers, among whom Signor Galileo has contrived to get 1000 florins for life, and it is said to be on account of an eye-glass, like the one which *was sent from Flanders to the Cardinal Borghese.* We have seen some here and they succeed well."

It will, after all, be very difficult to deny, that not only the rumour of the invention, but even some telescopes actually made, reached Italy from Holland, before Galileo ever made such an instrument. In May, 1609, there was a telescope in the hands of the Count de Fuentes. Another was in the possession of Cardinal Borghese; Lanccius, who came from Holland, is said to have made telescopic glasses at Venice; Fuccarius distinctly says, that one Dutch telescope was brought to Venice, and *that Galileo saw it.** But such is our respect for the genius and character of Galileo, that his mere assertion that he never saw a telescope when he set about making one; that he did not know its construction; that his friend Jacob Badorere, by whom he got intelligence of the invention from France, did not give him any information of the manner in which it was made—his simple assertion of all this is taken by us as conclusive against any presumption.

Nelli, in his *Life of Galileo*, says that the Florentine philosopher first heard of the invention in June, 1609. Galileo himself informs us, in a letter written in March, 1610, that he heard of the invention about ten months ago, which would fix the time of his first attempt to the month of May, 1609, the time when, we know from Sirturus, that a Frenchman brought a telescope to Milan.

Even after the very able manner in which the history of Galileo's discoveries have been recently given by an English author, it will not be superfluous to give Galileo's own account of the transaction.

In March, 1610,† he wrote in the following manner:—"It is about

* Kepleri. epistolæ, No. 309, p. 493. † Epist. 4. Td. Martii, 1610.

ten months ago that it came to our ears, that a glass* had been worked by a Belgian, by the help of which, visible objects, though at great distance from the eye of the observer, may be seen distinctly. (In the Italian of the saggiatore it is added *ne piu aggiunto, no more was added*, or *this was all.*) And some experiments were related of the admirable effects of this instrument, which some believed, and others not. A few days afterwards the same was confirmed by letters of a noble Frenchman, Jacob de Badorere, from Paris; all which occasioned me to apply myself wholly to inquire into the cause of this, and to think on the means by which the invention of a similar instrument might be brought about; in which I succeeded in a short time, assisted by the doctrine of refraction: and I first procured a leaden tube, at the end of which I adapted spectacle glasses,† both plane on one side, the one convex on the other side, the second concave. Bringing the eye near the concave glass, I saw the objects large, and near enough: they appeared three times nearer, and nine times larger, than if seen with the naked eye.

"Afterwards I made another instrument, which made objects appear sixty times larger.

"Finally, sparing neither industry nor expense, I succeeded so far as to make an instrument of such excellence, as to make the objects seen through it, appear a thousand times larger, and more than thirty times nearer, than if seen with the natural power of the eye."

Viviani, Galileo's favourite pupil and friend,‡ says that in the month of April or May, 1609, it was rumoured in Venice, where Galileo then was, that a Dutchman presented to Count Maurice, of Nassau, a certain glass occhiale, with which distant objects appeared as if they were nearer, *nothing more was said.*§ With this information only Galileo returned immediately to Padua, to try whether he could find out the construction of this instrument, in which he succeeded on the following night. The next day was employed in constructing the instrument, in the manner which he had imagined; and, notwithstanding the imperfection of the glasses which he procured, he saw the effects which he anticipated, and immediately gave notice of it to his friends in Venice. He constructed, after this, instruments of better quality; and six days later he took some of them to some elevated part of the city, and made the first senators of the republic observe distant objects, which they did with great admiration. Bringing constantly the instrument to greater perfection, he resolved finally, with his wonted liberality, to communicate his invention, and to make a free gift of it to the serene Prince and Doge Leonardo Donati, and to the Senate of Venice, presenting with the instrument a paper, in which he declares the construction, and the admirable use and results on *land and on sea*, which might be obtained from this invention. In consequence of this noble present, the serene republic, with generous demonstration of the 25th of August, 1609, wrote to Galileo, and a pension was granted him for life,

* Un occhiale, perspicillum.
† Vitrea perspicilla.
‡ Viviani vita del Galileo, p. 69.
§ *Ne piu oltri fu detto.*

with more than three times the salary, which it was the custom to give to a lecturer of mathematics.

Thus we perceive the Venetian Senators doing in August, 1609, the same thing which the members of the states-general had done in October, 1608, about ten months sooner. They ascended to high places for the purpose of gazing at distant objects. Both the Dutch and the Venetian magistrates nobly rewarded the invention, which was tendered to them. The Venetians rewarded Galileo as a philosopher should be rewarded, by an honourable station and independence. The Dutch treated Lippershey in the best way an artist can be treated; they gave a high price for his article, and made large orders for it. The date assigned by Viviani to these transactions, the 25th of August, 1609, agrees completely with what Lorenzo Pignoria wrote the 31st of August to Paolo Gualdo, and which letter was mentioned above.

It is exceedingly gratifying to observe, that Galileo almost immediately brought the telescope with a convex object-glass and a concave eye-glass, to all the perfections of which it is susceptible, without being achromatic. He observed with it all that could be seen by its means; he ascertained the power of his glass with great ingenuity, and he indicates the difference between linear and superficial amplification with perfect accuracy. His German biographer Tagemann, does not seem to have clearly understood this difference, for he appears to imagine that Galileo's telescope really had a power of 1000 times, whereas it was only of about 32.

In a Galileon telescope the focal length of the object-glass cannot go beyond a certain extent, without narrowing the field too much. The eye-glass cannot be made very deep without making it too thin in the centre. Even at present it would, perhaps, be difficult to make Galileon telescopes of greater power than 32, which is, indeed, that which Galileo obtained.

On the 7th of January, 1610, Galileo discovered three of the satellites of Jupiter; on the 13th, the four satellites were observed and recognised as satellites; but it is not my object to enter into that splendid train of discoveries which illustrated the name of Galileo, and which lately have been so well described. However perfect we allow the instruments of Galileo to have been, we see no reason to doubt that the satellites could be seen with the instruments made in Holland. The Italian authors certainly assure us that the Dutch telescopes were of an inferior description; but this assertion is wholly unsupported by proof. Indeed we know nothing of these telescopes except that they were long, (*tubi longi,*) and longer than 16 inches;* and it is not unrational to suppose, that with this length, they were equal to Galileo's telescopes. Admitting the length of the telescope to have been sixteen inches, and the negative focus of the concave eye-glass half an inch, the power of the telescope was 32, or equal to that of Galileo. The Professor Adrian Metius,† brother of the

* De vero telescopii inventore, p. 30.

† Adriani Metti, Institut. Astronom. et Geograph. Francq. 1614. Fondamentale en grondelyche ouderuysinge, ibid 1614. Adriani Metii tractatus de genuino usu utrusque globi, Francq. 1624. 4to.

co-inventor of the telescope, gives us some account of what could be seen with the telescopes then made in Holland. In a book printed in 1614, he says, "During the day several planets are observed near the sun, which were unknown hitherto to all men, but which can only be seen with the glasses, which my brother, Jacob Adriaansz, invented six years ago, (thus in 1608.) These planets show themselves first in the eastern part of the sun, and from thence pass over the sun to the westward, in about ten days, as I observed several times, principally about sunrise and sunset.

"With these same tubes some erratic stars or planets are seen, which have their course round Jupiter; but of these nothing can be stated with certainty, unless my brother be pleased to publish his telescopes, by means of which many strange things will be brought to light, as well about the moon as elsewhere. Yea, the observations of the stars may then be made with much greater accuracy; because, by means of these telescopes, it will not only be possible to observe minutes, but even seconds."

It does not appear from this quotation that the professor himself observed the satellites; nor does he even appear to be aware of their number. His brother Jacob, perhaps, gave him some incomplete information of the existence of the satellites. But *he saw* the spots of the sun, which may be seen with instruments of a less power; and he labours under the erroneous notion then common to many, that the spots were planets or satellites revolving round the sun.

But what the Professor says of *the accuracy* which the invention of the telescope is likely to insure to astronomical observations, is very remarkable. What does he mean by asserting, *that the observations on the stars will become accurate to a second?* Did the pupil of Tycho anticipate the application of the telescope to instruments of mensuration; to quadrants? I must own that it is difficult to take his distinct words in any other sense; and I am led to believe, that the idea of an invention, which did so much credit to Gascoigne, had occurred to Adrian Metius.

There is a passage in the English Life of Galileo, which ought not to pass unnoticed. The anonymous author accuses William Boreel, to whom he chooses to give the Italian name of Borelli, of glaring partiality against Galileo. "Borelli," says this author, "not satisfied with attributing the invention of telescopes to Zanssen, endeavours to secure for him and for his son the more solid reputation of having anticipated Galileo in the useful employment of the invention. He has, however, inserted in his collection a letter from John, the son of Zacharias, in which John, omitting all mention of his father, speaks of his own observations of the satellites of Jupiter, evidently seeking to insinuate that they were earlier than Galileo's; and in this sense the letter has been since quoted, although it appears from John's own deposition, preserved in the same collection, that, at the time of the discovery, he could be no older than six years. An oversight of this sort throws doubt on the whole of the pretended observations; and, indeed, the letter has much the air of being the production of a person imperfectly informed on the subject on which he

writes, and probably was compiled to suit Borelli's purposes, which were to make Galileo's share in the invention appear as small as possible."

I crave the liberty of replying to this passage, that if probabilities are to be introduced in the case, it seems extremely probable that the learned author of the Life of Galileo has never read Borel's book with sufficient attention, and, as the book is scarce, he knows it perhaps only from quotation. There is *no letter* inserted in it from John, the son of Zacharias; but in answer to some queries either from Boreel or from Borel, he gives two memorials or notes of what a telescope of his making could show. In the first place, he mentions the appearances and dark places in the moon; and it is to be observed, that what he says of the appearance of the moon seen through his telescope, answers exactly to what one would expect of a good instrument. It plainly shows, says John, the moon to be a sphere, with distinct edges, and not a plane. The following is his statement of Jupiter's satellites: he often observed the planet which shows itself round, well defined and spheric; near it he often saw two highly situated small stars, sometimes he saw three, and generally four of these small stars. As far as he could observe, they go perpetually in circles round Jupiter; but, he adds, this I leave to astronomers to determine, for it is not, says he, my business to make astronomical observations, but to furnish astronomers with telescopes as good as I am able to make.

I challenge the author of the Life of Galileo to point out the passage in Borel's book in which either Boreel, or John, the optician, exhibit the least intention of throwing Galileo's discoveries in the shade. But it may be permitted, I should think, to an optician, when asked by an ambassador at a foreign court, to state what the performances of his instrument is; and I believe that neither Mr. Dollond nor Mr. Tully could be justly accused of disparaging Sir William Herschel's merit, if they were to state that the Georgium Sidus is visible in their telescopes. John certainly says, in 1655, when he was fifty-two years of age, that he often saw four satellites with a telescope of his own making; but he never says that he saw the satellites before January, 1610, the epoch of Galileo's discovery, nor does he even mention *when* he first saw them. He is, he says, no astronomer, but an optician; and when this optician states, in 1655, that he makes telescopes with which the satellites can be seen, it is difficult to understand how it can be inferred that he made this statement in order to deprive Galileo of the honour of discovering the satellites in 1610. Thousands, certainly hundreds, saw the satellites in 1655; and why should not John, like other people? I, therefore, positively deny that any intention is shown in Borel's book, to depreciate the merits of Galileo; and as far as Boreel is concerned, considering his character and station in life, it is absurd to say, *that his evident object* was to make Galileo's share in the invention as small as possible; but if Boreel really undervalued Galileo's merits, let the English author quote, and point out the place *where* he did so. I must offer another remark on this same anonymous au-

thor. I am quite prepared to believe that the telescopes made by Galileo's own hands were as perfect as art could make them at the time; but it is to be lamented, if the original telescope of Galileo still exists in Florence, that no Italian philosopher has favoured us with an account of its performance. We have, however, a sort of criterion of what could be done by it. The belts of Jupiter were, as far as I know, never seen by Galileo; they were observed, after his death, or blindness, with instruments made by Evangelista Torricelli. But the author of the English Life of Galileo asserts, as proof of the inferiority of the Dutch telescopes, that in 1637, *Gaertner, or as he chose to call himself Hortensius*, wrote to Galileo, that no telescope could be procured in Holland, sufficiently good to show Jupiter's disk, well defined."* Hortensius wanted more than could be accomplished in his time; and even now, telescopes of a certain size, which show Jupiter's disk well defined, are not of every day's occurrence. Does this author know many telescopes excepting those made by Mr. Dollond or by Mr. Tully, capable of showing Jupiter's disk, *well defined;* nay, does he know one single telescope, *not achromatic*, capable of answering the claim of Hortensius. The anonymous author favours his readers with a translation of Hortensius name, which he pronounces to be *Gaertner*. He is mistaken, however: Gaertner certainly is the *German* of Hortensius; but he was *not* a German, and his name, in his mother tongue, was Van den Hore.

We find the celebrated Peirese, as late as 1622, doubting the invention of telescopes: in England, these instruments were known at a much earlier period. The celebrated English mathematician, Thomas Harriot,† actually observed the satellites of Jupiter, as early as the 10th of January, 1610, which is only *eleven days* later than Galileo's discovery. It is, indeed, astonishing, that an *English author* should overlook this circumstance. Harriot also observed the spots in the sun for the first time, on the 8th of December, 1610. They were first seen by Galileo in November of the same year. Harriot's telescopes had, it appears, powers of 10, 20, and 30. His observations run from the 16th of January, 1610, to the 26th of February, 1612; he gives drawings of the configurations and computations of their revolutions. Now, it may be asked, from whence did Harriot get the telescope with which he observed the satellites only a few days later than Galileo? Certainly not from Italy; he either made it himself, or got it from Holland.

But a few months later we find another English astronomer furnished with a telescope. Sir Christopher Heydon writes, on the 6th of July, 1610, to the well known William Camden:—"I have read Galileo, and, to be short, do concur with him in opinion; for his reasons are demonstrative; and of my own experience, with *one of your*

* Page 25.

† These observations and other manuscripts of Harriot, were discovered in 1784, by Baron de Zache, at Petrowth, in Surry, the seat of Lord Egremont. See Bode's Astronom. Tahrbuch, 1788, p. 155, Monatliche Correspondenz, t. viii. p. 144.

ordinary trunks, I have told eleven stars in the Pleiads; whereas no age ever remembers above seven; and one of these, as Virgil testifieth, not always to be seen.*

Telescopes were then, it appears, called *trunks*. Harriot, in his letters to Henry Percy, Earl of Northumberland, calls them *perspective cylinders*. It appears that the Earl possessed many of them, and that he wanted some more. It is to be lamented that Harriot's papers and manuscripts are at present buried in one of the libraries of the University of Oxford.

From all which has been said in this paper, the following facts may be established, as proved by authentic documents:—

That on the 2nd of October, 1608, John, or Hans Lippershey, a native of Wezel, a spectacle-maker of Middleburg, in Zealand, was actually in the possession of the invention of telescopes.

That, on the 17th of October, of the same year, 1608, Jacob Adriaansz, sometimes called Metius of Alkmar, in Holland, also was in possession of the art of making telescopes, and that he actually made those instruments; but that either from disgust, or some other reason, he afterwards concealed his invention, and thus actually gave up every claim attached to the honour of it.

That there is little reason to believe that either Hans, or his son, Zacharias Zansz, were also inventors of the telescope; but there is every probability that this Hans, or John, or his son Zacharias Zansz, invented a compound microscope about 1590.

That this Lippershey used rock or mountain crystal in the construction of telescopes, and that he is the inventor of the Cinoculus.

[*Jour. Royal Institution.*

On substituting Plates of Fusible Metal for Wood Blocks in Calico Printing, &c.—By M. G. ENGELMANN.†

THE engraving of wood blocks for calico printing is very expensive, and these blocks being also formed of an hygrometric substance, are continually subject to change from swelling and shrinking by the effects of moisture and dryness, and thus occasion a considerable loss of time; and give false impressions from the trouble of replacing them, and the consequent inequality in their adjustments. I have therefore endeavoured to substitute for them a substance which is not liable to swell by the action of humidity; can be moulded with great accuracy, and at the same time is capable of resisting the effects of the blows of the mallet, and of the acids contained in certain of the colours used in calico printing. The fusible alloy appears to me to offer these advantages, and I employ the *en cliché* process in its application.

I operate in the following manner:—Having made an engraving in wood on a piece of plank, and given a sufficient breadth to the

* Gulielmi Camdeni et illust. viror. ad G. Camden. Epistol. London, 1691, p. 128.

† From Bullet. de la Soc. Indust. de Muhlhausen; and Feurressac's Bulletin des Sciences Technologiques.

bottom of the lines to enable the cast to part from the mould, I interpose between the metal and the wood a substance which shall facilitate their separation; to effect this, I brush over the engraving a mixture of ground *sanguine*, (red chalk,) and water. I then finally affix the engraved block to the bottom of the upright slide or stem of the stamp, and let it fall suddenly upon the melted fusible alloy at the moment when it is just upon the point of becoming solid, or has acquired a *pasty* consistence, I thus obtain a counter proof of the engraving. This counter proof serves as a matrix or mould for the engraved plates of fusible metal which I intend to make. For this purpose I affix it to a piece of wood, and surround it with a border of metal, intended to determine the thickness of the metal plates struck in it, and which border is also formed in such a manner, as that whether placed on one side or the other it shall exactly fit; I then firmly affix this matrix, thus surrounded with its frame, upon the bottom of the stem of the stamp, and strike another counter proof *en cliché*, and so proceed until I have thus produced enough of them to compose and to cover a calico printing block.

These second counter proofs thus obtained, I place, with their engraved faces undermost, the one by the side of the other, upon a flat surface, and also shape and dispose them with the necessary regularity to insure precision in the impressions from them; I then pass a heated iron along the joints in order to solder one piece to another, and then fix the whole upon a wooden plank by means of copper nails, but I previously varnish the plank to prevent moisture from penetrating it. These blocks, if I may judge from the two experiments which I have made with them, offer no other inconvenience than being a little heavier than those made entirely with wood; they differ, however, but little from those blocks in which the raised parts are made with brass or copper,—a difference trifling in comparison with the great advantages they possess in not being liable to change from the action of moisture.

It is easy to see that a calico printing-block thus constructed must cost much less than one engraved upon wood, and especially as we need only to engrave a segment, or one of the parts, which are usually repeated a great number of times; and to multiply them by the *clichage*, an operation which will produce in less than an hour more casts than are sufficient to fill a block thickly covered with them. The value of the metal employed, and which need not be more than a line in thickness, is a mere trifle, and after the block has done its work may be remelted. We can preserve the small matrices which occupy but little room, and when we require to make another block it can be done quickly. It is also equally easy, in changing a moulded pattern, to vary the position of these small casts, since we can either bring them near together, or remove them to a distance apart; place them in a line, or mingle one piece with another, and thus either form them into borders, or employ them in the interior parts of the prints.

If we compare the price of these blocks, with those whose raised parts are formed of brass or copper, it is greatly in their favour; and we have no doubt that in the hands of skilful persons, the art of form-

ing them by means of *clichage*, will obtain as great perfection as those blocks possess. [*Repertory of Inventions.*

Mordant for Calico-Printers.—By Mr. Francis Davis, *of Cold Bath Square.*

From the Transactions of the Society of Arts.

Mr. Faraday has already noticed, in a periodical publication, the property which solutions of the salts of uranium possess, even with a superabundance of acid, of producing a red stain on turmeric test-paper, similar to that which is produced on the same paper by solutions of the alkalies. By pursuing Mr. Faraday's inquiries further than it appears that he himself carried them, I found that solutions of the salts of this metal give a reddish brown colour to paper made yellow by French berries, fustic, quercitron bark, and weld, as well as to paper impregnated with infusion of nut-galls. This suggested to me the possibility of adding to the mordants at present in use, one, which, when printed on calico, &c. would give, with the above-mentioned drugs, by means of the same copper of dye, an additional colour, and thus add a considerable variety to patterns of cotton-prints, without the trouble employed in dying them being at all increased.

The mordants at present in use, and the only ones, I believe, ever used in cotton-spinning, are alumina and the buff or deutoxide of iron. These are applied to the cloth, united with acetic acid, but are not fixed in it upon the same principle.

Acetate of alumina is of such a nature that, when its solution receives a high temperature, say about 212° Faht. part of the alumina is deposited. Being laid on cold, the cloth is afterwards passed round heated tubes, and thus alumina is deposited in intimate union with the fibre of the cotton, &c.

The case is somewhat different with respect to the iron mordant. The iron liquor, or solution of acetate of iron, contains this metal in the state of a protoxide, which is very soluble in acetic acid; and if, in this state, it be exposed to the atmosphere, a larger portion of oxygen is acquired, and the deutoxide of iron which is then formed being less soluble, precipitates. After the iron mordant has been applied to the cloth, it is necessarily exposed to the atmosphere, and consequently the oxide of iron is precipitated and fixed in it.

The oxide must be fixed in the cloth, that the latter may, before being put into the dye-bath, go through the cleansing processes to which the manufacturer is obliged to subject it after application of the mordant.

The oxide of uranium, before it can be applied as a mordant, must also be intimately combined with the fibre of the cotton, as I have shown to be the case with the others. I found that the acetate of uranium possessed neither the property of the acetate of alumina, nor of that of iron, and was in all respects unfit for the purpose required. It therefore became necessary to search for some liquid combination of uranium, which should resemble, in its mode of ac-

tion, one or other of those salts. As the three following solutions all possess the property of acetate of alumina, they appear to me to be well adapted to obtain the end proposed.

The yellow oxide of uranium (called by some the peroxide) is soluble with heat, in a solution of

The sub-carbonate of ammonia;
The bi-carbonate of soda; and
The bi-carbonate of potass.

To one or other of the above solutions, saturated with oxide of uranium, and become *cold*, add strong acetic acid in sufficient quantity to saturate the ammonia, soda, or potass employed; as, for example, to prepare the one in which the carbonate of soda is used, dissolve two parts by weight of this salt in sixteen parts by weight of water; this solution, boiled in one part by weight of oxide of uranium in powder, will dissolve it: when cold, add five parts, also by weight, of strong purified wood vinegar of commerce; agitate the mixture. The quantity of acetic acid added must of course depend upon its strength.

When the acid is added to the solution of the oxide, in any one of the above-mentioned salts, the transparency of the solution is not disturbed, nor is any of the oxide of uranium deposited; but if it be made to boil, it will exhibit the same property as a solution of the acetate of alumina, by becoming turbid; and if the ebullition be continued for a short time, the whole of the oxide of uranium will be precipitated, leaving, when the oxide has had time to settle, a colourless, supernatant liquor. This liquor being entirely colourless, may be considered as a criterion of the acid having been added in proper proportion to the other ingredients; for the liquor will retain a yellow colour, if the acid be added in too great or in too small a quantity.

Any one of these solutions, thus prepared, when mixed up with gum, and laid by a pencil on cloth, and this afterwards passed through the same heating process as that used for it when prepared with acetate of alumina, will be found to deposit the oxide so firmly in the fibre of the cotton, &c. as to qualify it to bear any cleansing to which the calico-printer may find it necessary to subject it. With respect to which of these solutions may be best adapted for this purpose, I think it likely that the one made with the sub-carbonate of ammonia will be found preferable; but as in this communication I intend to confine myself to that of which my experiments qualify me to treat, so I feel diffident in pronouncing positively upon the relative merits of these solutions, because, when used by me, they were only pencilled upon the cloth, instead of being impressed by the block of the calico-printer.

An obvious way of precipitating the oxide in the cloth must suggest itself to any person acquainted with the nature of metallic salts; namely, by printing the cloth with any of the soluble salts of this metal, and then dipping it into a solution of an alkali, or lime-water. There are many very serious objections to this mode of effecting the end proposed. I shall confine myself to stating two: first, it would

be introducing an additional manipulation—an inconvenience which will be avoided by the use of the solution of the oxide in the alkaline carbonates above proposed; secondly, when a piece of cloth, treated by me in this way, was passed through a dye-stuff, it was found to have received the colouring matter very unevenly, and exhibited a fainter colour than that imparted by the same dye-stuff to places mordanted by the solutions of the oxide in the carbonates, although a greater quantity of oxide was, to all appearance, fixed in the cloth by treatment with the alkali than by the other way. In this manner, indeed, a very permanent bright yellow colour, a circumstance which ought not to be lost sight of by the manufacturer, may be produced in cloth, without its undergoing any other preparation.

With Nutgalls.

In infusion of nutgalls solutions of the salts of uranium occasion a brown precipitate: it was therefore to be anticipated that the colour given by this dye to the uranium mordant would be the same. The colour received is, in fact, a dull brown. This appears to be as permanent as the black produced by iron, and stands washing as well. When used in conjunction with the iron mordant, colours having all the varieties that can be formed from these two may thus be produced in the same bath of dye. To ascertain whether the brown colour of the uranium mordant was produced by the same principle (generally considered as the gallic acid) which produces black with the iron, a piece of calico, previously dyed brown by uranium and galls, after being thoroughly washed, was boiled in a solution of muriate of iron, and, as might have been expected, was by these means changed to black.

With Weld and Quercitron Bark.

The colours obtained from these dying drugs resemble one another in every respect. They are yellow, brown, or faded-leaf colour: they appear as permanent in the sun's rays as the yellow that is given with alumina, and will stand washing. If uranium, alumina, and iron, be used together, a bright yellow, light brown, and dark olive green, as well as all the various combinations of these three colours, may be obtained by one bath of these dye-stuffs at the same time. This brown colour gave the same indications of the presence of gallic acid as the one from nutgalls, when treated with solution of muriate of iron.

With Fustic and French Berries.

But the most valuable property of the uranium mordant is, its producing, with the above articles, a very agreeable and permanent colour, varying from a light red to a chesnut colour. The colour from French berries approaches nearer to pink than that derived from fustic. It might be imagined that the gallic acid is concerned in producing these colours, as well as the ones obtained from weld and quercitron bark, as the infusion of both fustic and French berries will give a black precipitate with a solution of iron, in the same man-

ner as the infusion of weld or of quercitron bark; and they are also, as well as the two latter, capable of giving an olive-green colour with the iron mordant. But, notwithstanding those strong grounds for supposing that the colour produced by fustic and French berries is a compound of gallic acid and uranium, when tried by the test before mentioned, of boiling with a solution of iron, the colour was found to be very little, if at all, altered. The calico-printer will find, by the use of the uranium mordant, that he will be enabled to print a very permanent, and, as I think, a very desirable colour, by the use of either of these two drugs, which have only hitherto furnished fugitive yellows with alumina, the one from French berries being particularly worthless. If this colour may be said to change by being much washed, it is by becoming more red than at first.

Turmeric.

This dye is not capable of being fixed or rendered permanent in cloth either by this, or by any of the other mordants; and although, if the cloth be first dyed by turmeric, and then impregnated with a solution of a salt of uranium, it is changed to red, yet it returns to its original yellow colour with very little washing, indeed by merely holding it in a stream of running water.

Turkey berries, sumach, and valonea, are so similar in their properties to some of the drugs already noticed, that I have not considered it necessary to make any trial with them.

Annotta, when dissolved in an alkaline solution, the usual mode, I believe, of applying it, was not affected by uranium.

It was also tried along with the red dying drugs madder and cochineal, as also with logwood; but as no discovery, likely to be useful to the manufacturer, resulted from my experiments, I shall not trouble you with any remarks upon these dyes, further than by saying, that the colour imparted to it by madder, resembled that given by this drug to alumina, only of a considerable darker shade; and that received from cochineal was of a slate gray colour.

The oxide of uranium made use of by me was obtained from the pitch ore, or native sulphuret of that metal.—*Rep. of Inven.*

The Results of Machinery.

(Concluded from page 412, vol. 7.)

The examples hitherto quoted have exhibited the progress of improvement in works of the hand merely—*manufactures*, properly so called; but it is further shown, that in the operations of the mind there has been the same constant striving after abridgment of labour, attended with the same beneficial results.

"To all of you who read this book it is no difficulty to count a hundred; and most of you know the relation which a hundred bears to a thousand, and a thousand to a million. Many of you are able, also, to read off those numbers, or parts of those numbers, when you see them marked down in figures. There are many uncivilized people

in the world who cannot count twenty. They have no idea whatever of numbers, beyond, perhaps as far as the number of their fingers, or their fingers and their toes. How have we obtained this great superiority over these poor savages? Because science has been at work, for many centuries, to diminish the amount of our mental labour, by teaching us the easiest modes of calculation. And how did we learn these modes? We learnt them from our schoolmasters."

* * * *

"When a boy has got hold of what we call the rudiments of learning, he has possessed himself of the most useful tools and machines which exist in the world. He has got the means of doing that with extreme ease, which, without these tools, is done only with extreme labour. He has earned the time which, if rightly employed, will elevate his mind, and therefore improve his condition."

* * * *

"The foot-rule of the carpenter not only gives him the standard of a foot measure, which he could not exactly ascertain by any experience or any mental process; but it is also a scale of the proportions of an inch or several inches, to a foot, and of the parts of an inch to an inch. What a quantity of calculations, and of dividing by compasses does this little instrument save the carpenter; besides ensuring a much greater degree of accuracy in all his operations! The common rules of arithmetic, which almost every boy in England now learns, are parts of a great invention for saving mental labour. The higher branches of mathematics, of which science arithmetic is a portion, are also inventions for saving labour, and for doing what could never be done without these inventions. There are instruments, and very curious ones, for lessening the labour of all arithmetical calculations; and tables—that is, the results of certain calculations, which are of practical use, are constructed for the same purpose. When you buy a joint of meat, you often see the butcher turn to a little book, before he tells you how much a certain number of pounds and ounces amounts to, at a certain price per pound. This book is his "Ready Reckoner," and a very useful book it is to him; for it enables him to despatch his customers in half the time that it would otherwise require, and thus to save himself a great deal of labour, and a great deal of inaccuracy. The inventions for saving mental labour, in calculations of arithmetic, have been carried so far, that Mr. Babbage, a gentleman whose name we have twice before mentioned, has invented a calculating machine, which not only does its work of calculation without the possibility of error, but absolutely arranges printing types of figures, in a frame, so that no error can be produced in copying the calculations, before they are printed. We mention this curious machine, to show how far science may go in diminishing mental labour, and ensuring accuracy."

* * * *

"The effects of saving unprofitable labour are the same in all cases. The use of machinery in aid of *bodily* labour has set that bodily labour to a thousand new employments; and has raised the cha-

racter of the employments, by transferring the lowest of the drudgery to wheel and pistons. The use of science in the assistance of *mental* labour has conducted that labour to infinitely more numerous fields of exertion; and has elevated all intellectual pursuits, by making their common processes the play of childhood, instead of the toil of manhood.

It can never be too strongly impressed on the public mind—perhaps it is not sufficiently so in the treatise before us—that wherever there is a saving of labour, whether in mental or bodily operations, there is uniformly a progression in improvement. Articles are made not only at less cost, but a great deal better; calculations and deductions not only quicker but more accurately. The cloth produced by machinery is of a more equal and durable texture than that made by hand; and a pin is a more perfect cylinder than any hand could produce of so small a size. The slate and pencil may err, even in the expertest hands; but tables, which have stood the test of ages, never. Could all the labour which the common multiplication table has saved mankind, and all the errors from which it has protected them, only be calculated, the mind could hardly fail to contemplate with amazement, the vast good of which even this very simple, but most ingenious contrivance, has been the source.

The absurdity of the prevailing prejudices against the use of machinery is still further illustrated by an analysis of some of the more recent cases of combination against it. In December last, a band of agricultural labourers, in the neighbourhood of Aylesbury, destroyed all the machinery of many farms, down even to the common drills; but they *could not make up their minds* as to the propriety of destroying a horse-churn, and therefore they passed it over. But—

"Why should the labourers of Aylesbury not destroy the harrows as well as the drills? Why leave a machine which separates the clods of the earth, and break one which puts seed into it? Why deliberate about a horse-churn, when they are resolved against a winnowing machine? The truth is, these poor men perceive, even in the midst of their excesses, the gross deception of the reasons which induced them to commit them. Their motive is a natural; and if lawfully expressed, a proper impatience under a condition which has certainly many hardships, and those hardships in great part produced by the want of profitable labour. But in imputing those hardships to machinery, they are at once embarrassed when they come to draw distinctions between one sort of machine and another. This embarrassment decidedly shows that there are fearful mistakes at the bottom of their furious hostility to machinery."

The gross ignorance in which the agricultural peasantry are so generally sunk, may serve to account for the folly of these Aylesbury men; but there have been other classes of operatives equally foolish, for whom no such apology can be offered. The prejudice against machinery has not been confined to peasants who can neither read nor write, but has been largely shared in by the (comparatively) well-educated and well-paid artizans of our cities and towns—by those even who are most intimately connected with the diffusion of

knowledge—who live by books, and are, or ought to be, better acquainted with the wisdom that is in books than any other workmen whatever. Last September the operative printers of London, following the example of their brethren of Paris, came to a series of resolutions deprecating in strong terms the employment of machinery in printing, unless subjected to a heavy tax. The merits of this proceeding were well discussed in a letter, which appeared at the time, in the "Mechanics' Magazine" for October 9, 1830, and need not therefore be gone into again. From the journeymen printers the mania passed to the journeymen bookbinders of the metropolis, from whom a circular appeared about two months ago, calling upon their employers to give up the use of a machine for beating books.

"Books, before they were bound in leather, used to be beat with large hammers upon a stone, to make them solid. That work is now done in London by a machine. The workman is relieved from the only portion of his employ which was sheer drudgery—from the only portion of his employ which was so laborious that it rendered him unfit for the more delicate operations of bookbinding, which is altogether an art. The greatest blessing ever conferred upon bookbinders, as a body, was the invention of this machine. Why? It has set at liberty a quantity of mere labour without skill, to furnish wages to labourers with skill. The master bookbinders of London and Westminster state, that they cannot find good workmen in sufficient quantities to do the work which the consumer requires. The good workmen and the bad each were employed in the drudgery of beating, which called into action a certain muscular power of the arm and hand, which unfitted them for the delicacy and rapidity of other operations of bookbinding. The good workmen were therefore lessened by the drudgery of the beating-hammer; but the bad workmen, the mere labourers, whose work a very simple machine can do better, feel that they cannot compete with this machine. Why? They were indolent and dissipated, and the work which they neglected is now done without their aid. The great delay in bookbinding was always occasioned by the delay in beating. It was the mere drudgery which the better men paid others to perform; and these mere drudges, by the neglect of their work, kept the higher orders of bookbinders idle. And yet, in spite of their own experience, all the bookbinders try to put down the beating machine, which has a tendency, above all other things, to elevate their trade, and to make that an art which, in one division of it, was a mere labour.

"The objection of the bookbinders to the beating machine offers a remarkable example of the inconsistency of all such objections. The bookbinders have a machine called a plough, for cutting the edges of books, which is, probably, as old as the trade itself. A great deal of labour, and a great deal of material, are saved by this plough. Why do they not require that a book should be cut with a ruler and a pen-knife? They have presses, too, acting with a screw, to make the book solid and flat. A press with an iron screw will do ten times the work of a press with a wooden screw; and one of Bramah's hydraulic presses, which has power enough, if fully exerted, to break

a piece of wrought iron three inches thick, will do twenty times the work of the common iron screw press. Nobody insists that the master bookbinder shall use the press of the smallest power—that he may be compelled, at the same time, to use the labour of ten men instead of one. The objection would be too absurd upon the face of it. But a press of any kind is an *old* machine. A machine for beating books is a *new* machine. Working men, and other men, who ought to know better, have attempted to draw distinctions between old machines and new machines. As it is, the inventors of machines generally go before their age; and thus too many of them have either starved or struggled for years with want, because their own generation was not wise enough to value the blessings which science and skill had provided for it. But if the ordinary difficulties of establishing a new invention, however valuable it might prove, were to be increased by the folly which should say, we will have no new machines at all, or at any rate, a machine shall become old before we will use it, there would be an end to invention altogether."

After all, why should we be surprised at journeymen printers and bookbinders entertaining such mistaken notions when every body knows that these notions have their open advocates in all walks of life—even the very highest? Have there not been resolutions of justices as well as of journeymen against machinery? And have not the walls of both houses of parliament resounded with complaints of the manifold evils which the progress of mechanical improvement is bringing on the country? The truth is, that the prejudice we are contending against, pervades all ranks of British society to an extent which it is quite humiliating to think of. It shows that with all our freedom, all our facilities of acquiring knowledge, and all our boasted enlightenment, great numbers of us are still in a state of great darkness—so deplorably blind, as to be blind to the great source of all the blessings we enjoy. Most truly was it remarked by the correspondent, to whose letter we have before alluded, that were such demands as those of the journeymen printers to be listened to, the whole of that "complicated machine of society, which it has taken centuries to construct and put together, would be pulled to pieces in a few months;" and that it is to the refusal of such demands, "England and Europe owe their present glory." The same view of the matter is excellently enforced in the following eloquent passages of the little treatise before us.

"Society must either go forward or backward. There can be no halting place for any long period. * * * If the present state of popular feeling were to prevail and extend—if the brute force which seeks to destroy machinery were not to be put down by the power of the laws, and if the unwise prejudice which desires to depress it could not be conquered by the power of reason—the glory and prosperity of this country would be gone for ever. We should have reached the end of our career of improvement. We should begin a backward race; and it would remain for the inquiring savages of such countries as New Zealand and Otaheite to march forward. The night of the dark ages would return to Europe."

* * * * *

"There would be no new capital employed to give facilities to commerce and manufactures, whose prosperity is mainly the result of machinery. There would be no more capital for public works, which employ thousands of workmen in their construction. Would the rail-way from Birmingham to London be proceeded with, in which a capital of three millions sterling is to be employed, if the artisans of Birmingham were to break their machines? There would be an end of the commerce of Birmingham in that case; and then the rail-way would be given up, for the existing canals would have no employment, and there would be no traffic on the roads. The only use of roads would be to enable the starving workmen, (starved by their own folly,) to wander about the country in search of that profitable labour which they had destroyed. They would wander about in vain. The capital would make itself wings and fly away to other countries, where men still acted as reasonable beings. Our capital, our machines, and our best mechanics, would go to France and America. The tyranny of a mob would drive away the wealth and industry of the nation to places where they could be employed in security, just in the same way as the tyranny of a king drove the French silk and cotton weavers to this country a century and a half ago. The effects of all tyranny are the same, whether it be that of one despot or of many despots. Tyranny of any kind destroys our peace and our security. When men are in terror they try to save what they have got, instead of endeavouring to get more. Capital no longer does its work, labour is at an end.

"It is easy to perceive from these facts, which cannot be denied, that if, through the prejudices of some mechanics against machinery, the capital engaged in manufactures should be rendered as insecure as the capital engaged in agriculture, capital would go to other countries where such insecurity did not exist. The insecurity of capital employed in agriculture, and of capital employed in manufactures, would extend to capital employed in commerce; and the want of employment of capital in each of these great branches of human industry would produce a state of misery which it would be fearful to contemplate. We should all be more or less without food, without fuel, without clothes. The land would cease to produce corn, the mines would cease to produce ore, the forges would cease to produce tools, the looms would cease to produce cloth. There would be

> 'No kind of traffic,
> * * * * no name of magistrate;
> Letters should not be known: no use of service,
> Of riches or of poverty; no contracts,
> Successions; bound of land, tilth, vineyard, none;
> No use of metal, corn, or wine, or oil;
> No occupation; all men idle, all,
> And women too.'"

"The poet has well described the state of a community without industry, because without capital. It is the state of savages who bear its hardships, and who are few in number, because they are thinned by those hardships. But let a nation of twenty millions of people,

by any act of folly, drive capital away from them, and famine, pestilence, civil war, midnight murder, rapine, and every other dreadful calamity, would follow this unnatural violation of the laws of God and man. The twenty millions would soon be reduced to one million; the country would fall back a thousand years. We should all be idle, but our idleness would not feed or clothe us; we might all desire to labour but there would be no accumulation to give us profitable labour. We should all be prodigals who had spent our substance, and there would be no forgiving parent's home where our misery might be pitied and relieved when it is past endurance. The friend whom we had driven from us would never return. We could not go to the capital; the capital would not come back to us. The land would be depopulated, and rendered barren; and then the few that remained would have slowly to emerge from poverty and barbarism, by going back to the arts which the world has been laboriously acquiring for thousands of years."

Are there, then, really no evils attending the introduction of improvements in machinery? It is admitted that "every change produced by the substitution of a perfect machine instead of an imperfect one, of a cheap machine instead of a dear one," is a change which "more or less affects the interests of capitalists as well as of workmen," and "has more or less in it of the positive suffering and heart-wearing uncertainty which belongs to all change:" but it is on the other hand, very justly observed, that any injury such improvements may cause to individuals is only partial and temporary, while the benefits flowing from them are universal and permanent. "Every improvement brings healing upon its wings, even to those for whom it is a momentary evil—if it displace their labour or their capital for a season, it gives new springs to the general industry, and calls forth all labour and all capital to higher and more successful exertions." The evils, too, attending that state of change which necessarily follows a state of improvement, are susceptible of great mitigation; a wise government may do much towards that end—individual foresight and exertion still more. What the British government might accomplish in aid of British industry, the author of the treatise before us, professes not to discuss; but he has devoted a concluding chapter to showing the working people "the means which they possess in themselves" to bear up against every change that can befall them. The first thing, he says, they should do, is to get knowledge—*such* knowledge, that when deprived of one employment they may easily turn to another; the next, to get capital, that is, to lay by some money, on which they may fall back for support when they cannot dispose of their labour to advantage. No one can find fault with these precepts; so far as they go they are excellent; but who can say they go far enough? Are the means of getting knowledge and saving money so certainly within the reach of every working man in this country, that it can be fairly said to be his own fault if he is not possessed of a competent share of both? May not the march of honest industry be so impeded by artificial obstructions—by grievous imposts and annoyances at every step—that even the

best-disposed and the most hard-striving shall have good reasons to despair of ever getting above the pressure of their daily necessities? And if such artificial obstructions exist, ought it not to be one of the first concerns of the working man to have them removed? The writer of this treatise says, in the name of the society of which he is the organ, "it is not *for us* to point out what may be expected from the collective exertions of society;" *we* shall not attempt to discuss that part of the question which belongs to the duty of a government;" "*our* business is with the people themselves." But why the "*not?*" We must confess we do not comprehend the distinction here attempted to be drawn. What are the people without rulers, or rulers without a people? And though your business be only with "the people themselves," can you do better than tell the people how they may get rid of any shackles which a succession of foolish or iniquitous rulers may have imposed on them? It might not, we are aware, look well, or work conveniently, to see a society with a Lord Chancellor for its chairman, and a Chancellor of Exchequer, and the King's Attorney-General, on its committee of direction, urging the working classes to *agitate their grievances*—to besiege the houses of parliament and the palace of the King with supplications for the repeal of this or that oppressive burden—the repeal of the coal tax for example, which bears the hardest perhaps of all our public burdens on manufacturing industry,* or the removal of the fees on patents, which exacted for the enrichment of a few officers of the crown, (the Lord Chancellor and Attorney-General themselves among the number,) form one of the greatest obstacles to that advancement in mechanical improvement which it is the professed object of this treatise to promote. But though office, and the fees of office, may be very good reasons why the Lord Chancellor's Society for the Diffusion of Useful Knowledge should *now* be silent on such topics, they furnish no reason for the people being silent upon them. They only show how awkward a thing it is for *Ministers of the Crown* to write *books for the people*. Although professing to do "the business" of the people, they are obliged, from considerations personal to themselves, to leave one-half of that business undone. We think that no one can doubt that if the chairman of the Society for the diffusion of Useful Knowledge had been still plain Henry Brougham, he would have held it to be his very first "business with the people" to point out what their rulers ought to do for them as well as what they ought to do for themselves, and to exhort them to meet and petition, and remonstrate incessantly, till every unjust impost and vexatious regulation was abolished. But plain Henry Brougham is now Lord Brougham, and a leading member of the Cabinet as well as Chairman of the Useful Knowledge Society; and what it may be proper for him in the one capacity to say to the people, it is not expedient for him to say in the other; and so, to get

* See "Observations on the Duty of Seaborne Coal, and on the Peculiar Duties and Charges on Coal in the Port of London," an excellent pamphlet, just published by Messrs. Longman & Co. It is perfectly unanswerable.

over the difficulty, the whole of "that part of the question which belongs to the duty of a government" is left untouched! Not *altogether* untouched, however; for though the treatise before us says nothing about what the people should demand from their rulers, it is not wanting in significant hints of what the rulers *will do* if the people should think of taking the redress of their grievances into their own hands. At page 25 we meet with these words—"if the laws were passive, *which they will not be*, the most ignorant of the labourers themselves would see," &c. The portentous "*which they will not be*," is given in the original, as here, in italics, to impress the fact more forcibly on the mind of the reader, that the reader is speaking as with the voice of authority. The "schoolmaster" no longer chooses to discourse to you of popular grievances, but he shakes his birch as usual. Surely this little display of power might well have been spared. If it be true, (as who can doubt?) that nothing so disposes men to submit to hardships as a knowledge of the causes to which they are owing, and a conviction that they are in a course of being speedily remedied, so, on the other hand, it is very certain that if you tell a man that every thing depends on himself, when both you and he know well that much depends on others, and if you further make use of the terrors of the law to enforce this delusive half view of the case, nothing is more likely to make the counselled turn a deaf ear to those who counsel him. "Get knowledge and get money"—this is the sovereign panacea of the Useful Knowledge Society; but experience tells us there are many difficulties and obstructions in the way of getting knowledge and money, which, originating with the government, ought by the government to be first removed. It is altogether fallacious to say that the remedy "rests with the people themselves"—fallacious at least, in the sense in which these words are used by the Useful Knowledge Society: for, to reconcile them to truth, we must include in what, "rests with the people themselves" the right and the duty of petitioning for a redress of grievances; which right and duty are passed over by this society as of no account in relation to the question of want of employment. The society recommend, that when a workman is thrown idle by machinery, he should "strike into some new line of labour." But what, if in every new line which he thinks open to him he should meet with a lion in the path, in the shape of law of settlement, corporation privilege, government license, or something else equally oppressive and ridiculous? The society evidently blink a most important branch of the inquiry, when they do not show the workman how he may be freed from every restraint on his industry, and what he can himself do to work out his freedom. And they blink it—not because it is unfit the workman should be told this—but because it is unfit for a society, whose leading members have become Ministers of State, to play any longer the part of political agitators. We said, at the first establishment of this society, that it was not likely to work well for any great length of time; and that it owed its first chances of success mainly to the circumstance of its promoters being, for the time, in (what is called) opposition to the government—all for the people, and the

people's rights and interests. Verily, our anticipations are beginning to be realized.

Nevertheless, we acknowledge, most unreservedly, that, for the present treatise, so far as it goes, the British public have every reason to feel grateful; we must confess, too, that the defect which we have pointed out is a consequence of personal circumstances, which is more to be regretted than severely censured. Some other pen, less fettered by official considerations, will probably supply that branch of the inquiry which this treatise has left untouched; and though we have no longer the pleasure of seeing a Brougham and a Denman heading the popular array against the abuses of our political system, it is assuredly a great source of consolation, that they have been elevated, by their eminent talents and virtues, to offices which give them more power than ever, to carry into effect those reforms which it has been the great business of their lives to advocate and enforce. [*Mechanics' Magazine.*

Biscuit Baking by Steam.

Until within the last few years, all the flour and biscuit consumed in the navy was furnished by private contract. The most flagrant impositions and frauds were but too generally the consequence of this mode of supply, in defiance of all the vigilance of the heads of departments. The flour and biscuit were stipulated to be of the second-best quality; but instead of this, the former was generally mouldy, damaged, or of a very inferior description to that bargained for; while the latter was usually compounded of bad flour, bean meal, old worm-eaten biscuits ground down, and various other cheap or unwholesome materials. To obviate these frauds, government, a few years ago, erected steam-mills at Deptford and Portsmouth, for the purpose of grinding flour for the navy; and a very superior and cheaper article being the result, it was determined, in addition to grinding the flour, to attempt also the manufacture of biscuit from it, at these establishments. The impossibility of accommodating and effectually superintending the multitude of bakers required to knead the dough in the usual way, by hand, so as to effect the supplying of the whole navy, would have rendered this praiseworthy effort, in a great measure, abortive, had not the ingenuity of Mr. Grant, storekeeper at Portsmouth, obviated the difficulty. By the attachment of a few simple pieces of machinery to the engine driving the flour-mill, the dough is now worked, rolled out, and stamped into biscuits, with an expedition inconceivable, and with a saving of two-thirds of the number of bakers required to perform these processes by hand. The flour and water are first put into a trough, through which passes an iron spindle, armed with eighteen knives, in two rows, *i. e.* nine in each row, on opposite sides of the spindle. A strap connected with the engine turns the spindle round; and by means of the revolving knives, the flour and water are in a few minutes worked into dough fit for being stamped into biscuits. The dough is now taken

piecemeal from the trough, and shaped by hand into longish rolls, upon two moveable baking-boards, supported by small iron pillars, having castor-wheels at top: these pillars are in three rows, extending from the trough to the two rolling machines; and along the castors upon their tops the baking-boards are pushed, by hand, towards the rollers, under which the dough is rolled out into thin cakes, by their backward and forward swinging motion. The baking-boards are now pushed out, by hand, from under the rollers, and slided along three other rows of pillars connecting the two rollers with the two cutting machines, each containing forty-two hexagonal dies, under which they are momentarily placed, and eighty-four biscuits thus cut out by a single stamp of the two machines. The kneading, rolling, and stamping portions of the machinery, being all separate, can consequently be put in motion or at rest at the will of the baker. By the machinery at Portsmouth, under Mr. Grant's superintendence, 160,000 pounds of biscuit can be manufactured in twenty-four hours—constituting a day's ration for the crews of twenty sail of the line; and with eight or ten such pieces of machinery, biscuit rations may be daily manufactured for 160,000 men, being the greatest number of seamen and marines employed during the hottest period of the war. About 5,000*l.* has been expended in erecting the baking apparatus at Portsmouth; a considerable portion of which expense was naturally occasioned by the alterations and improvements consequent on the erection of a new piece of machinery; but even this sum will be refunded to government during the first year of its employment, by the saving made. This saving of expense, however, is not the only recommendation—the biscuit being free from flutiness, and in every respect more palatable than that baked by hand, in consequence of being more thoroughly kneaded. From the rapidity of the manufacture, also, no more biscuit need now be baked than is required for immediate use, from the supply by this process being as certain as it is rapid; so that our seamen will in future have always fresh-baked and wholesome biscuit served out to them, even on foreign stations, instead of the stale, mouldy, worm-eaten, and unpalatable contract trash generally furnished during the war, which had often been baked for years before issued. It is only those who have been doomed to the penance of the contract flour and biscuit that can duly appreciate the great boon conferred upon our brave seamen by this project of the government; the above articles now supplied to the navy being very superior in quality to those furnished the merchant service—such, indeed, as are fitting for any gentleman's table; and all this at a much lower cost than the former contract supplies.

The first bags of biscuit of this manufacture having, in addition to the usual King's mark of the broad arrow, the word "machinery" stamped in capital characters upon them, this novel and imposing symbol at once struck the eyes of the superstitious tars as something very mysterious, and many were the solutions attempted of the enigma; until one, more deeply read than the rest, dropping upon one knee, and rolling his quid round and round in his mouth, while

tracing with his finger and spelling and re-spelling over and over the ominous word, at length started up from his reverie, and exclaimed with an oath, "Why, it aan't only the name of the squab of a baker—Mac Henry, Mac Henry, that's all that's in it!" and the "machinery biscuit" is now, consequently, known among the tars by the cognomen of "Mac Henry's biscuit." P. C.

[*Literary Gazette.*

The Silver Isis Medal and Five Pounds were presented to Mr. T. Lowthorp, *25 Crescent street, Euston Square, for his Emery Cloth; samples of which have been placed in the Society's Repository.*

There is an immense consumption of sand paper and of emery paper, both in private families for cleaning furniture and utensils of iron and steal, and still greater in manufactories of hardware of all descriptions. But paper is so brittle that it will not hold together after having been used a little while, and, unfortunately, this happens just when its quality as a polisher is the best, from the coarser grains of sand or emery having been rubbed off.

By substituting the cheapest kind of calico for paper, the candidate has produced an article, the durability and utility of which far exceed the additional cost required by the substitution of cloth for paper.

The sand, pounded glass, and emery, are to be sorted by washing over in the usual way, and then are to be dried for use.

The calico best suited for this purpose should be thirty-two inches wide, of a strong even thread, but not too coarse, and which has been as little dressed as possible. It is to be put into stretching frames two yards long, and, after being wetted with warm size, is to be stretched to a width of thirty-six inches. The size employed for this purpose is composed of 2 lbs. of good glue, dissolved in six quarts of warm water, and then mixed with two quarts of water that has previously been boiled with half an ounce of alum; and six ounces of good wheaten flour. The mixture is to be put over the fire in any convenient vessel, and, when it begins to bubble, is to be poured out into a pan for use.

On the dry calico, still in the frame and stiff with the coating of size, is to be laid on another coat of a stronger size, made by dissolving 4 lbs. of glue in three quarts of warm water, and adding one pint of the first size, together with an ounce of gum arabic and an ounce of gum tragacanth.

While this strong size is yet wet, the emery, sand, or glass-powder, is to be sifted on as evenly as possible, and the calico is again set to dry, and is afterwards brushed, to remove the loose particles: a second coating of strong size is then to be laid on, and is to be covered with another layer of sifted emery, &c. It is then again to be dried and brushed, and is now ready to be removed from the frame, and cut up into sheets for sale or for use.—[*Register of Arts.*

On the Illumination of Light-Houses. By Lieut. Thomas Drummond, *of the Royal Engineers.*

[From Abstract of Meeting of Royal Society.]

The author, after briefly describing the different methods at present employed for illuminating light-houses, proceeds to detail what he considers an improvement upon those now in use. This consists in substituting for the Argand burners a small ball of lime, ignited by the combustion of oxygen and hydrogen.

From this small ball, only three-eighths of an inch in diameter, so brilliant a light is emitted, that it equals in quantity about thirteen Argand lamps, or 120 wax candles; while, in intensity or intrinsic brightness, it cannot be less than 260 times that of an Argand lamp. These remarkable results are deduced from a series of experiments made lately at the Trinity-house; and, having been repeated with every precaution, and by different individuals, there seems no reason to doubt their accuracy. In the best of our revolving lights, such as that of Beachy Head, there are no less than thirty reflectors, ten on each side. If, then, a single reflector, illuminated by a lime-ball, be substituted for each of these ten, the effect of the three would be twenty-six times greater than that of the thirty. On account of the smaller divergence of the former it would be necessary to double their number, placing them in a hexagon instead of a triangle. In this case the expense is estimated at nearly the same. This method was tried lately at Purfleet in a temporary light-house, erected for the purpose of experiments by the corporation of the Trinity-house, and its superiority over all the other lights with which it was contrasted was fully ascertained and acknowledged.

On the evening of the 25th of May, when there was no moon-light, and the night dark, with occasional showers, the appearance of the light viewed from Blackwall, a distance of ten miles, was described as being very splendid. Distinct shadows were discernible, even on a dark brick wall, though no trace of such shadows could be perceived when the other lights, consisting of seven reflectors with Argand lamps, and the French lens, were directed on the same spot. Another striking and beautiful effect peculiar to this light was discernible when the reflector was turned, so as to be itself invisible to the spectator. A long stream of rays was seen issuing from the spot where the light was known to be placed, and illuminating the horizon to a great distance. As the reflector revolved, this immense luminous cone swept the horizon, and indicated the approach of the light long before it could itself be seen from the position of the reflector.

These singular effects, must not, however, be understood as constant accompaniments of this light, for on a moon-light night, or when the weather is very hazy, they cease to appear.—[*Jour. of Roy. Ins.*

Photometer, or Instrument for measuring the relative Intensity of two Pencils of Light. By Mr. W. RITCHIE, A. M. F. R. S.

[From the Transactions of the Society of Arts.]

A PHOTOMETER is an instrument for the purpose of comparing the relative intensity of light given out by different bodies in a state of combustion or incandescence. There are two modes of measuring light, either by the actual comparison of the lights themselves, or of the shadows produced by intercepting part of the lights. The former was employed by Bouguer, to whom is owing the construction of the first photometer, and the latter by Count Rumford.

The general mode of operating is the same in both; that is, the two lights or shadows to be compared are brought to an apparent equality on a particular spot, and the relative intensity is obtained by measuring the distance from this spot to each of the luminous objects, and then squaring the distance so found. Thus, if the lights or shadows of two lamps are equal, one being at the distance of two, and the other of three feet, the illuminating power of the former will be expressed by four, and of the latter by nine.

In practice, it is found more convenient to have the lights stationary, and to move the photometer, than the reverse; and it is on this latter principle that Mr. Ritchie's photometer is constructed and employed. It consists of two mirrors, placed at right angles to each other within a wooden box open at both ends, in order to admit the rays from the two luminous objects to be compared: these rays are reflected upwards to a slit in the top of the box, which slit is covered with semi-transparent white paper. A wooden trunk, widening upwards, is raised upon this slit, for the purpose of enabling the observer to compare the two portions of reflected light without disturbance from any other rays. The two lights to be compared, and the two mirrors, being brought into one straight line, the photometer is to be moved along this line till the reflected rays from both objects appear to be precisely equal: the relative distance of each from the photometer being then measured or read off, these numbers squared give the relative intensity of each light.—[*Rep. of Pat. Inven.*

CLEMENT'S *Experiment—Easy Mode of Repeating it.*

THE very curious, and apparently paradoxical experiment, first described by Clement, in which air, gas, or steam, issuing with force from a hole in a flat surface, did not blow away a platter or other flat and extended body, but rather caused its adhesion, has been repeated since in a great variety of forms. M. Hachette contrived a simple little apparatus, by which every one was put in possession of the power of witnessing the effect: and such facilities are valuable, because they rapidly extend the knowledge of curious effects, and cause them to be still more extensively pursued and investigated. The experiment may be still further simplified in the following manner. When the fingers of the open hand are retained as close to each other

as they can be, still there are certain slit-like intervals between them extending from joint to joint. Let the hand be held horizontally with the palm downwards, apply the lips to the interval between the second and third fingers nearest to their roots, and then blowing with force, a strong jet of air will of course issue from the aperture at the under side of the hand. Now, put a piece of paper or a card three or four inches square against that aperture, and again blow; it will be found that the paper will neither be blown away, nor fall by its own weight, but will be pressed upwards against the hand and the issuing current of air, so long as that current continues. The moment it ceases, the paper will fall away by its own gravity, in obedience to the ordinarily active laws of nature.—M. F.

[*Jour. of the Roy. Institu. Feb.* 1830.

On the Discharge of a Jet of Water under Water. R. W. Fox, *Esq.**

The following letter is addressed to the Editors of the *Philosophical Magazine.*†

"I am not aware, that it has been before noticed, that a jet of water discharges the same quantity, in water, as in air, in a given time, without reference to the depth or the motion of the water, at least within certain limits. Thus when the experiment was tried with a head of water six feet high, the same orifice discharged equal quantities in equal times, in air, in still water, and in a rapid stream, moving at the rate of about six feet in a second; the jet having in one case been turned with the current, and in another against it: and when, by lengthening the tube, the aperture was submerged to the depth of fifteen feet, the effect was the same as at the surface, under the pressure of an equal column above it. These results have been obtained by my brother Alfred Fox and myself, and you may perhaps think them deserving a place in your magazine, if they should appear to you to be new.

"We sometimes coloured the water, when the jet appeared to pass unbroken to a considerable distance under the water."—*Ib.*

On Preventing the Discharge of a Bullet from a Gun by the Finger.

At the sitting of the Helvetic Society of Natural Sciences of the 28th July last, a letter was read from Dr. Flachin of Yverdun, relative to an experiment before mentioned to the society, in which the

* By a reference to the 2nd volume of this Journal, page 61, it will appear that experiments on this very subject, with a similar result, were made by James P. Espy, of Philadelphia, in the year 1828. These are his words: "I have lately ascertained, by some experiments in hydraulics, (which I shall publish before long,) that as much water runs out in a given time through a hole in the side of a vessel containing water under a given head, when the egress is made below the surface of water, as when it is made in the open air."

† Vol. viii. p. 342.

ball was prevented from leaving the bottom of a musket when the gunpowder was fired, simply by putting the ramrod upon the ball, and the end of the finger upon the ramrod. He supposes the effect may be explained by the circumstance, that near the charge the ball has a very small velocity compared to that impressed upon it by the expansive force of the gases from the fired gunpowder, when exerted during the whole of the time in which it is passing along the barrel. It is well known that the effect thus accumulated is the reason why long pieces carry further than short ones, and why the breath of a man, which cannot exert a pressure of more than a quarter of an atmosphere, may, by means of a tube, throw a ball to the distance of sixty steps. The experiment above requires great care, especially as to the strength of the piece, which is very liable to burst in the performance of the experiment.*—[*Ib.*

New Lamp.

Among the useful applications of scientific knowledge to our improvement in domestic articles, we have this week to mention a lamp of a new construction, and on a new principle, which was exhibited on Friday at the Royal Institution, and one of which is now burning on our table before us, affording us the light by which we describe its brilliancy and good qualities. It is the invention of Mr. Parker; and certainly for illumination is equal to oil gas, which it surpasses in steadiness and equability. The essence of the invention is, that a column of air keeps the oil always at the proper height of the wick, so that the flame is continually of the same splendour, without flickering. Yet the machinery is most simple, and the form agreeable. There are no rims to cause shadows; and altogether we do not know when we have been more pleased with a thing of the kind for daily use or ornament. The new lamp is truly a new light.—[*Lit. Gaz.*

Extraction of Potash from certain Minerals.

This alkali, so important in the arts, may, it is stated, be extracted from minerals containing it, by a very ample process. This consists in merely calcining them with lime, and then leaving them for some time in contact with water, which is afterwards filtered and evaporated. M. Fuchs, as quoted in the *Ann. de l'Industrie*, states, that he has in this manner obtained from 19 to 20 per cent. of potash from felspar, and from 15 to 16 per cent from mica.—*Ib.*

On the Machinery for Making Paper.

At a meeting of the Royal Institution, in London, Mr. Cowper read a paper on the recent improvements in paper making.

These observations were intended as an appendix to a lecture on the same subject, delivered by Mr. Millington in this Institution two

* Bib. Univ. 1830, p. 447.

or three years ago. Mr. Cowper described the mode of making paper by the machines of Hard and Fourdrinier, for the sake of those of his auditors who were not present at the former lecture. Next, the beautiful machine invented by Mr. Dickenson was illustrated by drawings and experiments. This machine differs considerably from Fourdrinier's: in the latter, the pulp flows upon a horizontal web of wire, about thirty feet in length, stretched on rollers, upon which it revolves; the water from the pulp flows through the web, and leaves the paper on its surface; and as the water drains from the pulp merely by its own weight, it requires about 11 feet in length of wire-web, moving at the rate of 22 feet per minute, or, in other words, half-minute time, to allow the pulp to become sufficiently set before it can be taken off the wire. In Mr. Dickenson's machine, a perforated brass cylinder, about 20 inches in diameter, covered with wire-web, and nearly immersed in the pulp, is substituted for the endless web in Fourdrinier's. The idea is very ingenious. The cylinder is turned truly inside and out,—it is perforated all over by holes and grooves, so disposed that when covered first with a layer of plain wires, and afterwards with the wire-web, there is no part of the wire-web which does not communicate with the interior of the cylinder. The ends of this are closed, and it revolves on a hollow spindle or pipe, which has two or three small branch pipes, bent downward within, but not touching the cylinder: these pipes, from their action, may be called siphons. An air-pipe enters the hollow spindle at one side of the cylinder, and is bent towards the interior upper surface, where it is united to a sort of trough, the edges of which apply themselves closely to the interior, by means of packing, *i. e.* the interposition of any elastic substance. A vacuum is constantly produced in this trough by the air pump: the trough extends 8 or 10 inches along the circumference of the cylinder, all of which part is above the surface of the pulp, in which the rest of the cylinder is immersed. As the cylinder revolves, the water flows through the wire-web into the interior, whence it issues by the siphons through the hollow spindle. The current of water flowing through the wire draws the floating fibres against the cylinder, and the paper continues forming, till, in the course of its revolution, it rises over the vacuum trough. Here the pressure of the atmosphere comes into action, and the remaining water is instantly forced through the wire-web, and the sheet taken up by a blanketed roller. The paper is thus made in the space of a few inches, the machine moving at the rate of 48 feet per minute. Mr. Cowper exhibited a working model of the machine invented by him for preventing the loss, by what, we believe is technically called shavings; a loss varying from one-sixth to one-twelfth of the whole paper manufactured. The model was furnished with a reel of tissue paper, about 200 feet long: the longitudinal cutting is effected by circular knives, and the transverse cutting by a serrated knife, which divides the paper easily, accurately, and with a sufficiently small edge. A drawing was also exhibited, to illustrate Mr. Ibbotson's new strainer for preventing the knobs which are sometimes found in paper. Mr. Cowper concluded by noticing the gratifying results of the improvement in paper making and print-

ing machines; observing that the Bible Society expended between 50,000*l.* and 60,000*l.* annually on paper and printing; the Tract Society also, he stated, frequently printed upwards of 400,000 of a single tract; other societies for the diffusion of knowledge, whose names he mentioned, printed of each number of a series as many as 20,000; and of the new editions of Sir Walter Scott's Tales about 1000 volumes were printed in a day. [*Ib.*

To our Cotemporaries.

We must remind certain of our cotemporaries across the water, that courtesy requires the acknowledgment of the source whence articles are derived, particularly when they are of considerable length and value; we trust these general remarks may suffice.

Com. on Pud.

Meteorological Observations for June, 1831.

	Days.	☉ Sun rise.	☉ Therm. 2 P.M.	☉ Baromet. Sun rise.	☉ Baromet. 2, P. M.	☉ Dew point	☉ Wind. Direction.	☉ Force.	☉ Water fallen in rain.	☉ State of the weather, and Remarks.	☽ Moon. Days.
				Inches	Inches.				Inches.		
	1	71°	82°	30.00	30.04	60	West.	Moderate.		Hazy morn—clear & dry.	
	2	74	83	29.95	29.94	62	West.	do.		Clear day.	
	3	76	87	.94	.89	64	West.	Breeze.		Cloudy day.	
	4	78	88	.74	.74	64	S. S.	do.		Cloudy day.	
	5	71	83	.69	.69	57	W. W.	Blustering		Rain—d'dy—rain in night.	
	6	68	78	.90	.90	50½	W. W.	Moderate.		Clear day.	
	7	68	81	.94	.94	52	NW. NE.	do.	.47	Clear day.	
	8	68	83	30.00	30.00	50	NW. E.	do.	.10	Clear day.	
	9	68	84	30.04	30.04	52	E. S.	do.		Fog—clear.	
	10	68	86	.06	.06	54	SW. W.	do.		Fog—clear.	
	11	68	86	.00	29.95	57	W. W.	Breeze.		Clear day.	
	12	68	86	29.90	.85	64	W. W.	do.		Cloudy—clear.	
	13	72	88	.85	.85	66	SW. S.	do.		Clear day.	
	14	72	88	.85	.85	66	W. W.	do.	2.93	Cl'dy—cl'r—thun. shw'r.	
	15	68	84	.90	.90	65½	W. SE.	do.	.12	Cl'dy—shw'r. frain night.	
	16	68	84	.90	.90	68	NE. W.	Moderate.	.2	Cloudy—slight showers.	
	17	67	84	.90	.90	68	NE. W.	do.		Fog—Flying clouds.	
	18	68	84	.90	.90	71	W. W.	do.	.2	Fog—clear—showers.	
	19	68	84	.90	.90	72	W. W.	do.		Cloudy day.	
	20	71	84	.90	.90	68	W. W.	do.	.2	Clear—cloudy—rain.	
	21	72	84	.90	.90	70	SE. W.	do.		Cloudy day.	
	22	66	83	.85	.85	55	W. W.	do.		Clear—flying clouds.	
	23	66	68	30.15	30.15	48	NE. NE.	do.	.65	Rain.	
	24	53	72	30.10	30.10	43	W. N.	do.		Clear day.	
	25	50	72	.10	.10	43	W. W.	do.		Clear day.	
	26	53	72	.10	.10	46	W. W.	do.		Cloudy—clear.	
	27	57	73	29.90	29.90	51	W. W.	do.		Clear day.	
	28	64	75	.70	.70	61	W. SE.	do.		Cloudy—rain.	
	29	70	77	.80	.85	68	SW. SW.	do.	.4	Flying clouds—rain.	
	30	63	80	.90	.90	62	BSE. W.	do.	1.80	Cloudy—flying clouds.	
Mean		67.03	81.67	29.86	29.89	62.3	W. SE.		5.49		

In. of rain in the month.

	Thermometer.		Barometer.	
Maximum height during the month,	92.	on 1st and 2nd.	30.15	on 24th.
Minimum do.	52.	on 24th and 25th.	29.65	
Mean do.	74.35		29.885	